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ANOTHER TRANSPORT.

Newport News, Va., Oct. 30—The United States army transport Buford, which has been at the ship yard here for the last three months being remodeled, left a few days ago for New York. The Buford was, before the war department purchased her, the Mississippi of the Atlantic Transport Co.'s fleet. At the time of the purchase she was hastily refitted and used during the Spanish war. Since she has been in the yard here, however, she has been converted into one of the finest troop ships in the service. She is now fitted to carry 100 first-class passengers, her officers and crew and 1,002 soldiers. Quarters for first-class passengers and officers are almost equal to those of the finest ocean liner. By adding an entirely new deck to the vessel, the officers' and passengers' quarters are placed above the hull. On the deck is a large dining saloon for the ship's officers and army officers. Forward of the saloon is the writing and smoking room, which is fitted with a number of handsomely finished oak tables. The captain's apartments are directly under the wheel house.

On the promenade deck is the wheel house, in the rear of which is the chart room. Two powerful search lights are provided, one on either side of the wheel house. Aft of the chart room are twelve lifeboats, and a steam launch will be put aboard at New York. On the forward bridge there are two 6-pound rapid-fire rifles and there is also one 6-pounder aft.

On the third deck down, or mess deck, the soldiers are fed. Here is also situated the ship's galley, where five cooks will be constantly at work. This galley is arranged in the most modern style, all the cooking being done by steam. Forward of the mess room on this deck is the soldiers' smoking and writing room. This is furnished with a large number of combination writing and card tables. All writing materials are furnished to the soldiers. Aft of the mess room is the hospital, where thirty-six patients may be cared for. The operating room, surgeon's office, toilet room, etc., open into this room, while aft of the main ward is an isolated ward for the use of patients suffering from contagious diseases. This ward is completely separated from the other parts of the ship. It has its own attendants' room, galley, toilet room, etc.

The two lower decks are fitted entirely with sleeping accommodations. The berths or bunks of the soldiers are in a series of iron frames, twenty-four berths to each frame. Aft on one of the decks is the soldiers' bath and toilet room. There are about 1,200 tons of pig iron in the hold of the vessel for ballast. An entirely new electric light system has been placed in the ship, and the fresh water system is also new. All the water used on the vessel is distilled from salt water. The first-class quarters are heated by steam, while the soldiers' quarters are heated by hot air. Cold air may also be used. A new refrigerating plant is another improvement in the vessel. The propelling machinery has been completely overhauled but has not been changed in any way. A new steam siren and whistle have been added.

BUSY SHIP YARDS.

In busy times ship builders fight shy of government work—not vessels of war for which the large yards are specially equipped, but such craft as dredges, revenue cutters and vessels other than those for the navy. The builders that might handle this kind of work do not take kindly to the extreme exactness of government specifications, unless they can see a liberal margin in their contracts and very often the amounts appropriated for such vessels are not up to requirements. The announcement, therefore, that Major Thos. H. Handbury of the United States army engineer corps of Detroit, who is a member of the Mississippi river commission, has been unable to find a builder who will undertake the construction of the dredge Benyaurd within the appropriation of $350,000 provided for the vessel is a fair indication of the active condition of ship building operations throughout the country. This dredge, which is of the self-propelling, hydraulic kind, was very fully described in a recent issue of the Review. When bids were opened in Detroit a few days ago there was just one offer to build the vessel. It was from the Townsend & Downey Ship Building & Repair Co. of New York, and the price named was $389,000, or $39,000 more than the sum available. Another call will probably be made for bids and a much greater length of time allowed for completing the dredge. The work was to have been done within ten months.

SENT TO THE MARE ISLAND YARD.

Naval Constructor F. B. Zahm has been ordered to the Mare Island, Cal., navy yard to take charge of the construction work at that important point. Mr. Zahm has been on duty in Washington for the past few years as principal assistant to the chief constructor of the navy, Admiral Hichborn, and in that capacity has been called upon to discharge many important functions. His transfer to Mare Island is in the nature of a marked promotion in view of the important work that is thereby devolved upon him.

The British battleship Majestic, flagship of Vice Admiral Sir Harry Rawson, commander-in-chief of the channel squadron, is now being fitted with Marconi's wireless telegraphy apparatus, the instruments supplied by another inventor not having proved successful. Other ships to be fitted are the Magnificent, Hannibal, Jupiter, Furious and Pactolus. In this connection it is well to note that the United States navy has reopened negotiations with Marconi for the installation of his system.

The navy department has decided to locate the new $1,000,000 dry dock at the Brooklyn navy yard between docks 1 and 2, as recommended by a majority of the board appointed to select a site for it. The minority reported in favor of the old Cob dock.

NOTES FROM SHIP YARDS OF THE GREAT LAKES.

A wooden steamer of about 3,000 tons capacity was launched at Green Bay, Wis., a few days ago, and named Orion. The vessel was built by her owners, Capt. P. F. Thrall and Mr. O. L. Harder, and will be owned by the Green Bay Vessel Co., which they control. The Orion is 282 ft. over all, 270 ft. keel, 42¼ ft. beam and 16 ft. depth at the midship hatch. She has eight hatches and two pole spars. The hull is steel arched and strapped and is very strong in all its parts. Engines are fore-and-aft compound with cylinders of 25 and 52 in. diameter and 40 in. stroke. They were made by H. G. Trout of the King Iron Works, Buffalo. The boiler, 11½x13 ft. and allowed 130 lbs. pressure, was built by Johnston Bros. of Ferrysburg, Mich. Other machinery includes a steam windlass of Bath Iron Works make, Williamson steam steerer and a hoisting engine furnished by the Chase Machine Co. of Cleveland. There are also two stockless anchors of Baldt manufacture.

The steel steamer Georgetown, which was built by the Union Dry Dock Co. of Buffalo for the Atlantic Coast Lumber Co., represented by J. L. Crosthwaite of Buffalo, was launched Saturday afternoon. She will start for the coast in a few days. A duplicate vessel, the Waccamaw, built by the Craig Ship Building Co. of Toledo, O., left the lakes only a week or two ago. These vessels will enter the coast lumber trade and will work in conjunction with the Georgetown & Western Railroad of North Carolina. The Georgetown is 258 ft. long, 40 ft. beam and has a molded depth of 18 ft. 3 in. She is fitted with triple expansion engines and Scotch boilers, with everything modern in the way of auxiliary machinery, and is in hull construction suited to the coast trade.

At the close of each season of navigation on the lakes for several years past it has been announced that the Graham & Morton Transportation Co. would build a new passenger steamer. The same announcement is again gravely made. President J. H. Graham is thus quoted: "We shall let the contract and begin work on the steamer the latter part of March. We intend to make her one of the finest steamers on the lakes. She will be constructed of steel, will be 250 ft. long and will have a carrying capacity of 4,000 passengers. She will be used mostly as a day boat and will make from 20 to 22 miles per hour."

The Loyalty and Liberty, two steel tow barges that are to tow in Atlantic coast trade with the steamers Paraguay and Asuncion, building at Cleveland, were launched at West Superior, Wis., a few days ago. It is expected that one of the steamers and the two barges will reach the coast within the next week or two, but the other steamer will probably not be finished in time to go down this fall. These vessels are managed by Mr. A. B. Wolvin of Duluth.

James Davidson of West Bay City, Mich., says he is undecided as yet regarding the construction of wooden vessels at his ship yard during the coming winter, but he thinks he will put down two or three keels.

CHANCE OF A RACE.

It is now hoped—but not at all certain, of course—that next year will see a race between the fast Detroit steamer Tashmoo and one of the side-wheelers of the Cleveland & Buffalo Transit Co.'s line. Mr. A. A. Parker, representing the Tashmoo, has placed a check in the hands of Capt. J. W. Westcott of Detroit to cover the deposit of Mr. T. L. Newman, representing the Cleveland & Buffalo line. The broad condition is that the race is to be held in still water. Mr. Parker mentions the route between Fort Gratiot and Sand Beach, Lake Huron, while Mr. Newman would have the race take place on Lake Erie. Like newspaper circulation quarrels, negotiations for steamboat races are usually of the never-ending kind. The string to money deposits on both sides in the controversy between Messrs. Newman and Parker is the question "Where will the race take place?" The deposit in one case provides for a Lake Huron course and in the other a course on Lake Erie.

REORGANIZATION OF UNION DRY DOCK CO.

When the American Ship Building Co. acquired control, more than a year ago, of nearly all the ship yards of the lakes, it was thought that the property of the Union Dry Dock Co. of Buffalo would eventually be owned by the consolidation. All efforts in that direction seem to have failed, however, and now it is announced that a new corporation, the Union Ship Building Co., is in possession of the Buffalo works and that Mr. Edwin Gaskin is to have associated with him in the new organization Mr. Lewis Wakefield of New York. It is understood that extensive improvements are to be made in the plant. The Union Dry Dock Co. was controlled by the Erie Railroad Co., but the relations of the railroad company, if any, to these works in the future have not as yet been publicly explained.

It is understood that before he arranged with the American Ship Building Co. for the construction of eight steel steamers, J. C. Gilchrist of Cleveland offered to pay $350,000 for the wooden vessels of the Wilson Transit Co.'s fleet—five steamers and a tow barge. The purchase was to include the profitable ore charter under which the vessels were working, but even with that bonus the price named would now very probably be considered high.

The Russian cruiser Novik, 25 knots, has been launched by Schichau at Dantzig. She is of 3,000 tons displacement and will carry six 4-in rapid-fire guns. An improved Novik, officially termed torpedo cruiser, is about to be laid down.

The Normand water tube boiler is rapidly rising in favor in Russia, and it is reported that several new Russian warships will be equipped with boilers of this type.

TWIN-SCREW STEAM YACHT ARROW.

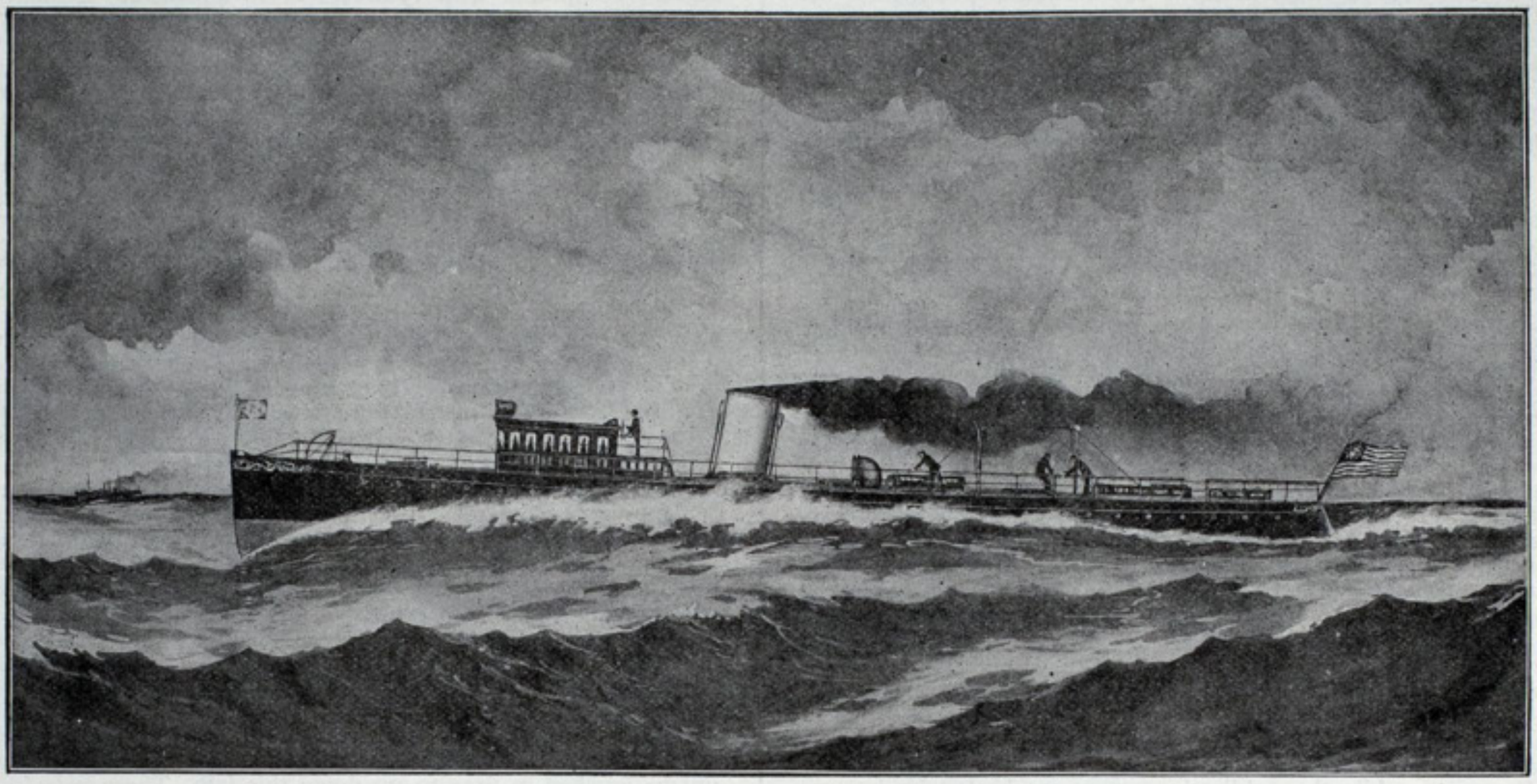
DESCRIPTION OF A VESSEL WHICH CHARLES D. MOSHER HAS DESIGNED FOR CHARLES R. FLINT, TO HAVE A SPEED APPROXIMATING 46 MILES AN HOUR

The twin-screw steam yacht Arrow, designed by Mr. Charles D. Mosher of New York city for Mr. Charles R. Flint, also of New York, is undoubtedly the most notable recent example of a boat intended to attain the highest possible speed by the use of the most advanced and refined features of engineering practice, both in the design and construction of the hull and machinery. Particularly on account of the remarkable speeds already attained by Mr. Mosher on his steam yachts Yankee Doodle, Norwood, Feissen, Presto and Ellide. The problem involves first the design of a form of boat suitable for the development of extreme speeds, and second the construction of the boat and machinery with a minimum of weight of materials. The realization of such an ideal involves so many special problems of design and construction that the following description of the boat and her machinery will be of interest to all who are concerned in the attainment of extreme speeds and the development of the maximum power on the minimum weight. In this yacht, however, there will be comfort, even luxury, in addition to the hitherto unheard of speed. The accommodations will in no sense be limited by the machinery necessary to propel the craft in this unprecedented manner, as there will be sleeping apartments for no less than twenty-five persons. The engines and boilers are very compact as well as ingenious specimens of advanced mechanism, there being as many as twenty-two steam cylinders aboard the yacht. So Mr. Flint's boat is expected to possess the greatest speed of not only any steam yacht, but of any craft ever constructed. She is particularly designed for conversion into a torpedo boat if necessary. The chief dimensions of the Arrow are as follows:

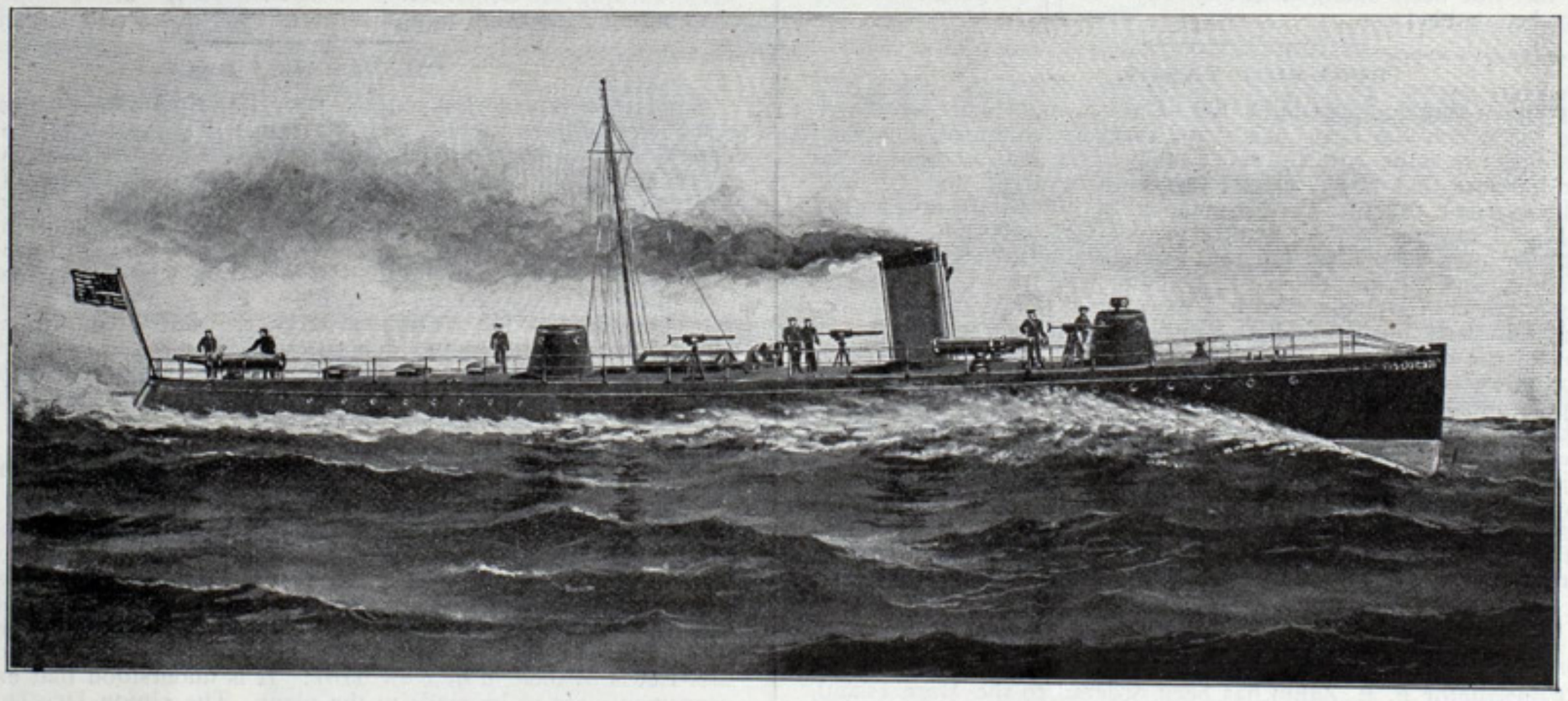
Length, extreme	130 ft. 4 in.
Length, on water line	130 ft. 0 in.
Beam, extreme	12 ft. 6 in.
Normal draught of hull	3 ft. 6 in.
Draught under screws	4 ft. 7 in.
Depth amidships	9 ft. 4 in.
Displacement at normal draught of 3 ft. 6 in	67.66 tons
Coal bunker capacity	17 tons
Water tank capacity	1,500 gallons

GENERAL DESCRIPTION OF THE YACHT.

This boat is fitted with six transverse water tight bulkheads, dividing the hull into seven compartments. Eight feet abaft the bow is a collision bulkhead, the compartment forward being used as a trimming tank, and providing a large storage reservoir for fresh water. As shown in the plans the crew's quarters are situated next abaft the collision bulkhead and extend the full width of the vessel for 15 ft. of its length. Ample accommodations and folding berths, lockers, toilet, etc., are provided for twelve men. Next to the crew space are located the officers' quarters, consisting of a double stateroom, which is also the full width of the boat and 7 ft. 6 in. long. It contains a desk, two extra folding berths, two large clothes presses, bureau with ample drawers and toilet equipment. Between the officers' quarters and the bulkhead at the forward end of the boiler space is the galley, which occupies the full width of the vessel for a length of 10 ft. 6 in., and which is provided with a large range, spacious ice chest, ample closets, sinks, tables, sideboard, fresh water tank and sufficient space for stores for an extended cruise. A stairway leads from galley to main deck. Next is the boiler room, which extends to the engine room bulkhead and occupies 30 ft. 6 in. of the vessel's length. In this space are two boilers of the Mosher patent water tube type, which are more especially described at a later point. Alongside the boilers are the coal bunkers which extend nearly the entire length of the



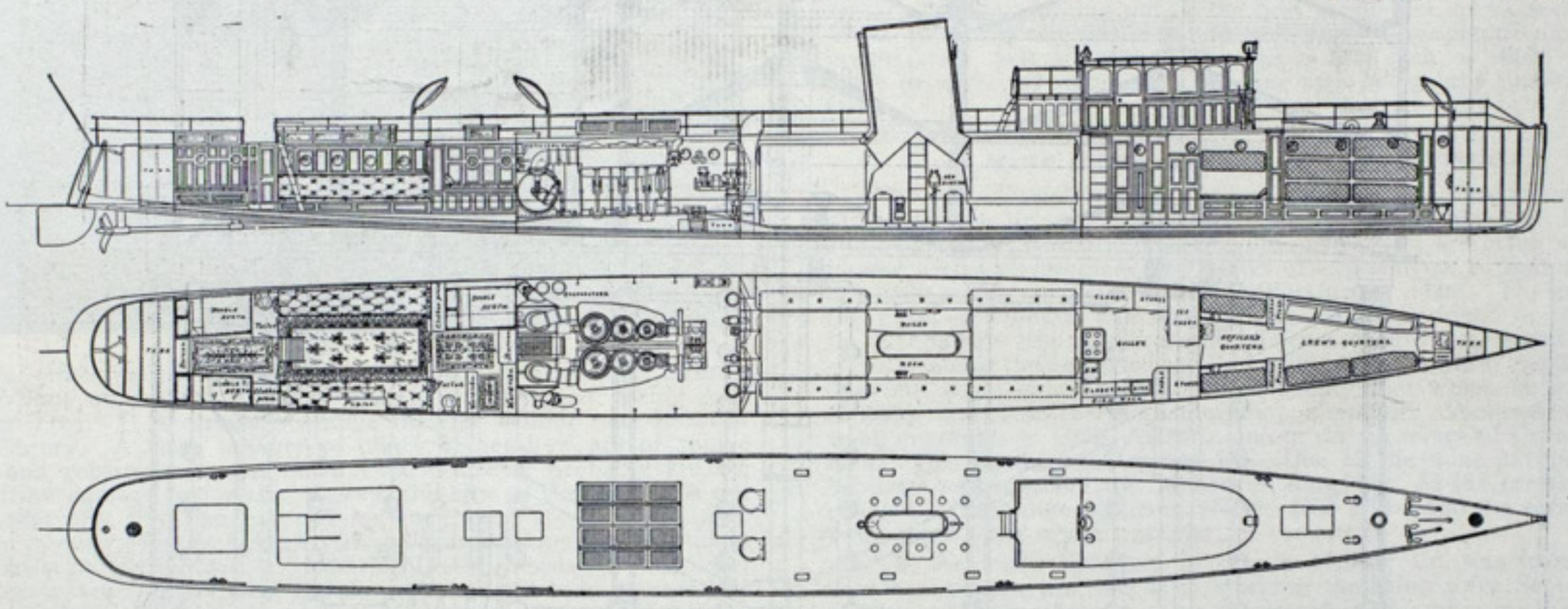
TWIN-SCREW YACHT ARROW, DESIGNED BY CHAS D MOSHER, TO MAKE 46 MILES AN HOUR.



TWIN-SCREW YACHT ARROW AS SHE WOULD APPEAR CONVERTED INTO A TORPEDO BOAT.

boiler space and have a capacity of about 17 tons, while additional coal storage space will provide for a total capacity of about 30 tons, or a sufficient amount to enable the vessel to cruise upward of 3,000 miles. Aft of the boiler space is the engine room containing two of the Mosher patent quadruple expansion engines presenting a number of special features referred to more particularly hereafter. Immediately aft of the engine room is the owner's stateroom, which occupies the full width of the ship and is 7 ft. 6 in. long. This room will be handsomely fitted up and will contain a large double berth, chiffonier, clothes press, two wardrobes and private bath, the joiner work being of satin wood. It will be lighted by monitor top and four large port lights, and at night by a number of incandescent lamps. Next aft is the saloon, which is 13 ft. 6 in. long and occupies the full width of the boat. It is to be most luxuriously fitted up and will contain a grand piano, library, an octagon buffet in each corner and gun racks, etc., for a full sporting outfit. The saloon is arranged to be converted into four staterooms by hanging draperies and is lighted by numerous clusters of incandescent lamps of variegated colors. These lamps are connected through an ingenious switch by means of which any color of light may be had as desired. The joiner work is to be of English oak and the ceiling of Hungarian ash. The saloon is lighted by eight large port lights, besides being lighted and ventilated by a monitor top, through which leads the companionway. Aft of the saloon is a double stateroom finished in Hungarian ash and elaborately furnished, being fitted with two large berths, dressing case, large chiffonier, a wardrobe and folding wash basin. This is lighted also by a monitor top as well as by four large port lights. A toilet room is arranged to open conveniently from both the saloon and stateroom. Aft of the stateroom is the after collision bulkhead, and aft of this is a fresh water tank holding 300 gallons, and also a store room of 360 cu. ft. capacity.

It will be noticed that the deck is particularly roomy, being clear of the usual houses. The pilot house, the only deck house carried, is 15 ft. long, and is arranged to be used as a dining room. The after portion is divided off and arranged as a pantry. It is provided with silver and china closets and is also fitted with a dumb waiter, which connects with the galley below. Aft of the pilot house is the bridge, 2 ft. 6 in. above the deck and fitted with steering wheel, compass and binnacle, engine room telegraph and powerful search light, controlled both from the bridge and within pilot house. Under the bridge is located a spacious store room.



GENERAL PLAN AND DECK PLANS OF FAST TWIN-SCREW YACHT ARROW.

LIBERAL USE OF ALUMINUM IN THE HULL.

The general construction of the boat is composite in character. The frames are steel below the water line and aluminum above, except through the boiler and engine spaces, where they are of steel throughout. The keelson, all floor plates, reverse frames, bunker bulkheads, boiler saddles, engine foundations and many other details, are also of steel. The sides are double planked with mahogany brought to a smooth fair surface, and highly finished. The deck is of wood except over the boiler space, where aluminum is used. The deck beams are of aluminum bulb angles. Aluminum is also used for many other details, such as side and deck stringers, hatch framing, hatch covers, brest hooks, etc. The outer keel, stem and stern posts, flooring, pilot house, joiner work and other like features are of selected woods to best meet their respective purposes. Between the frames and sheathing on the sides and bottom, as well as between the deck plating and beams, a system of diagonal strappings is fitted, consisting of thin steel plates about 8 in. in width, tapering at ends. This diagonal bracing or strapping is built in under tension and is intended to aid in the rigidity of the boat as well as tying the boat together longitudinally, and in providing the necessary transverse and torsional strength and stiffness. Two small boats will be carried, a 15-ft. cutter and a 13-ft. dingey. The yacht is to be fitted with quite an extensive electric plant capable of supplying sixty incandescent lights, and a powerful search light, and is also provided with two powerful blowers for ventilation and for supplying forced draft for the boilers. Surface condensers with circulating pump have a special engine, and there are also bilge pumps, and six powerful ejectors, having a combined capacity of over 100 tons of water per hour.

Turning now to the boilers we find that there are two of the Mosher patent water tube type. Particulars of the boilers are: Grate surface 120 sq. ft.; heating surface, 5,540 sq. ft.; pressure to be allowed by United States steamboat inspectors, 444 lbs. per sq. in.; weight of two boilers empty, 12.86 tons; weight of boilers in steaming condition, 15.59 tons; weight per sq. ft. of heating surface without water, 5.2 lbs.; weight per sq. ft. of heating surface with water, 6.3 lbs. The usual full working pressure is intended to be about 400 to 440 lbs. at the boilers and 350 lbs. to 400 at the engines. The boilers are provided with Mosher feed water regulators, all parts of which are entirely outside the steam drums and are unaffected by the rolling or pitching of the vessel. There is one fire room common to both boilers. In the boiler space are two specially designed blowers, two independent duplex feed pumps, two feed water regulators and a hydraulic ash ejector, besides the usual gages and fittings. There are two separate hatches for entering the boiler room, each fitted with a large port light. The fire room is lighted by four large deck lights.

DESCRIPTION OF ENGINES.

Leading particulars of the two engines are: Diameters of cylinders, 11, 17, 24 and 32 in.; stroke, 15 in.; working pressure at cylinders, 350 to 400 lbs.; revolutions, 540 to 600; piston speed, 1,500 ft.; calculated power under 540 revolutions and 350 lbs. at the engine, about 4,000 I.H.P. Both engines exhaust into one condenser, which has a cooling surface of 2,760 sq. ft. Between the steam cylinders of the engine a series of reheaters is installed, each one of which is capable of supplying the entire thermal equivalent of the work expended during the expansion, thus keeping the steam in a superheated condition throughout its working cycle. These are intended to aid in the drying of the steam and effectually preventing cylinder condensation. The air and feed pumps are just forward of the main engine and are geared directly to the main shafts. An important and interesting feature of the design of these engines is the arrangement of the columns and diagonal braces constituting the supporting framework of the steam and valve cylinders. This arrangement is designed to eliminate the danger of crystallization and fracture, due to rapidly alternating compressive and tensile strains, to which the framing of extreme high-speed and high-powered engines of this class are commonly subject. Diagonal braces are secured together in pairs at their centers by means of a bolt and nuts, by the adjustment of which the supporting columns can be subjected to a compressive and the diagonal braces to a tensile strain which is intended to be in excess of any normal working strains which may come upon them. By this arrangement, it is obvious that the supporting columns will at all times be practically subjected to compressive strains only, varied in intensity as the working strains of the engine increase or relieve the initial stress due to the tension of the diagonal braces. These braces are in turn subjected to tensile strain only of varying intensity, but constant to the extent of taking up and absorbing practically all the initial elasticity of the structure. A remarkably rigid construction is thus attained assuring a practically perfect alignment of the engine at all times and greatly eliminating vibration, since the initial or starting movement, without which there can be no vibration, is effectually prevented.

ELABORATE FEED WATER HEATING ARRANGEMENT.

The feed water before returning to the boilers is heated in a pair of Mosher patent four-stage or compound feed water heaters, which are placed near the boiler room bulkhead. This style of heater is formed of a cylindrical shell with hemispherical ends, and a series of transverse partitions dividing the internal space into four compartments. The compartment at one end is provided with a connection for the feed inlet and that at the other end with a like connection for the outlet. Series of tubes pass through the several partitions and connect the two end compartments to each other, thereby forming a continuous conduit for the feed water, which thus traverses the several compartments in series. The spaces surrounding the tube in the compartments constitute independent chambers separated by the partitions and thus adapted to receive steam of different pressures for supplying the heat required. The first chamber is connected with the main exhaust pipe from the low pressure cylinder, and the feed is first heated from this source. It then passes on into the second chamber, the steam side of which is supplied from the low pressure steam chest or third receiver. In like manner the third chamber is supplied with steam from the second intermediate steam chest or second receiver, and the fourth and last chamber from the first intermediate steam chest or first receiver.

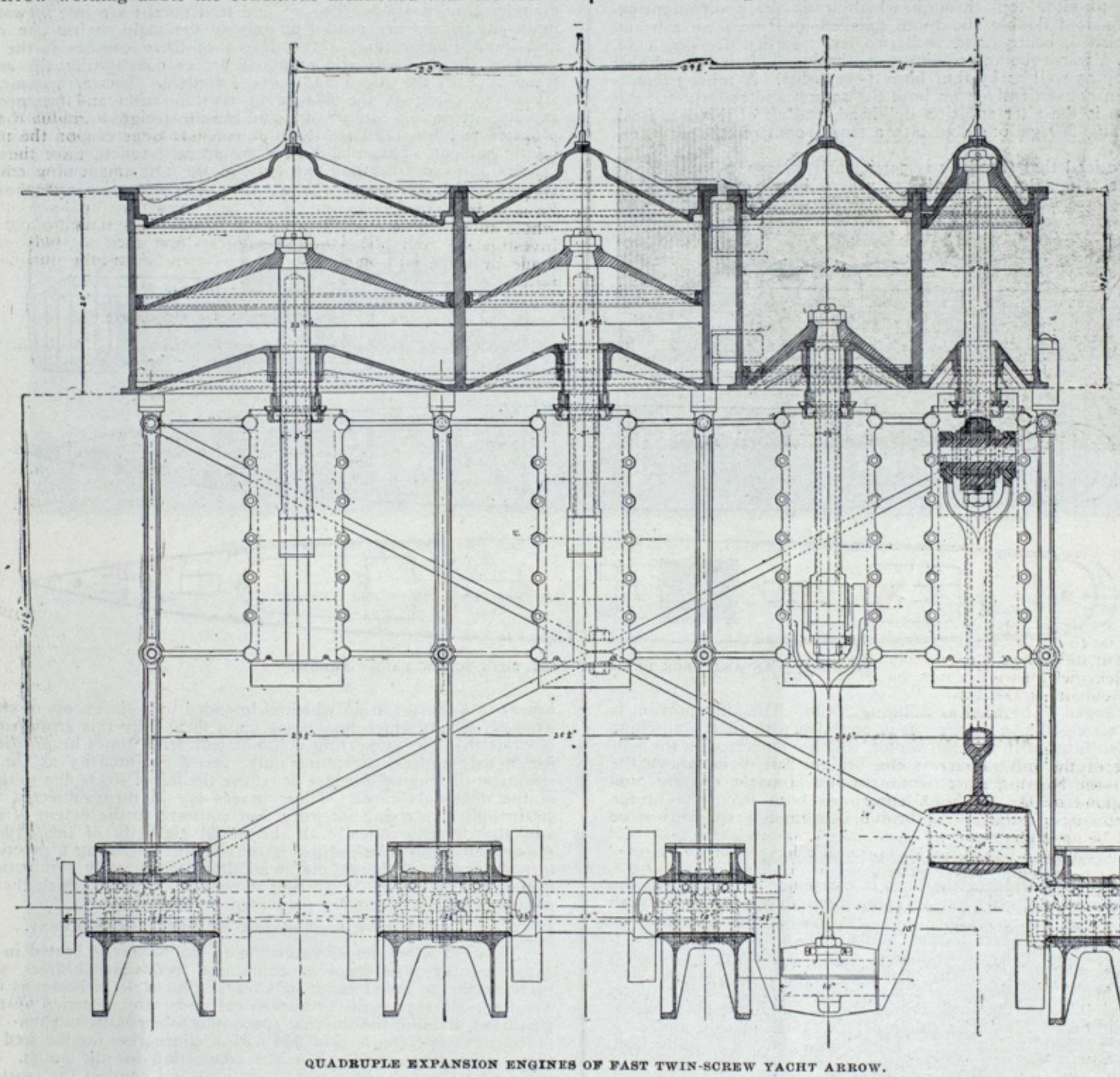
In this manner the feed water is successively heated by a series of transfers of heat from the expanding or working part of the steam cycle, at a series of increasing temperatures until it is finally delivered to the boiler at a temperature calculated to be about 350 degrees. It is only recently that the full thermodynamic significance of this operation has been realized. Examination shows, however, that such a series of heat transfers aids directly in bettering the efficiency of the engine, by reason of the modification which is thus introduced into the steam cycle, such modification having the effect of carrying the working cycle nearer to the ideal than it would otherwise be. The result is therefore a closer realiza-

tion of the conditions for the cycle of the ideal engine, and hence a correspondingly higher efficiency. In order to carry this operation to the fullest extent and thus to realize substantially the full ideal efficiency, it would be necessary to take the feed water and raise it by an indefinitely large number of very small steps from the lower temperature to that of the boiler, drawing the steam for each step from the point in the expansion stage of the engine having a temperature only slightly greater than that of the water itself. In this way each increment of heat would be given up from the steam and received by the water at very nearly the same temperature, and by such a series of operations the water would be raised to the temperature in the boiler. Such would very nearly fulfill the conditions for the heating of the water requisite to realize the highest efficiency so far as this part of the cycle is concerned; and it is thus claimed that the four stage heater as above described makes a close approximation to the practical fulfillment of these conditions.

ECONOMY OF ENGINES—SPEED EXPECTED.

A paragraph from the designer of the Arrow summing up the power expected from the engines and the probable speed of the vessel is as follows: "As stated above, the power which is expected from the engines of the Arrow working under the conditions mentioned with 350 lbs. of steam is about 4,000. The following relations will be of interest in this connection: I.H.P. per sq. ft. of grate surface, 33; heating surface per I.H.P. at 4,000 H.P., 1.39; weight per H.P. of engines and boilers, including water and all auxiliaries, 17.78 lbs. In connection with the designed power, the points which will make for high economy, and hence for a large return per pound of boiler and per pound of coal, may be briefly summarized at this point. The initial pressure is far beyond that which is found in current practice, even with torpedo boats and other high speed crafts. The increase is from 100 to 150 lbs. This pressure corresponds to an elevation of the initial temperature of about 30 degrees and this would correspond to a gain of about 7 per cent. in the ideal efficiency as compared with that for say 250 lbs. pressure, while if the pressure was increased 150 lbs., or 400 lbs. at the engine, corresponding to a rise of about 44°, it would in the ideal engine correspond to a gain of nearly 11 per cent. as compared with the usual practice of 250 lbs. We may next note the very considerable wire drawing from the boiler to the engine, which will tend to dry and superheat the steam, and thus to aid in reducing the wastes due to internal condensation. The action of the reheaters will also serve in the same line to keep the steam dry or even superheated as it passes through the successive cylinders of the engine. The total number of expansions will be about 15.67 and they are carried out in a quadruple or four-stage expansion engine with the corresponding gains which may be justly expected when using steam of such high pressure as is here employed. To these various features we must add the action of the four-stage feed water heater as described above. Then in the engine itself the cylinder clearances have been by careful design reduced to a very low value, a feature directly favorable to high efficiency of operation. Considering these various features bearing on the question of the economy of the engine, it seems not too much to expect an exceedingly economical development of power. It would be, of course, unsafe to predict a water rate, but it would certainly not be surprising if it should fall to the vicinity of 10 lbs. per I.H.P. per hour. A further question of the greatest interest is in regard to the speed which may be expected. Here again predictions are unsafe as there is no precedent approaching the great increase of power per unit of displacement, but considering that the form of the boat has been especially designed for the attainment of the highest possible speeds, involving a large amount of model experiment directly carried out by the designer, and assuming that 4,000 I.H.P. and probably more are developed on a mean displacement of 60 tons, or somewhat less for a speed run, a speed of something over 40 knots or 46.25 statute miles per hour may be confidently expected."

In the engine room of the Arrow there are in addition to the two



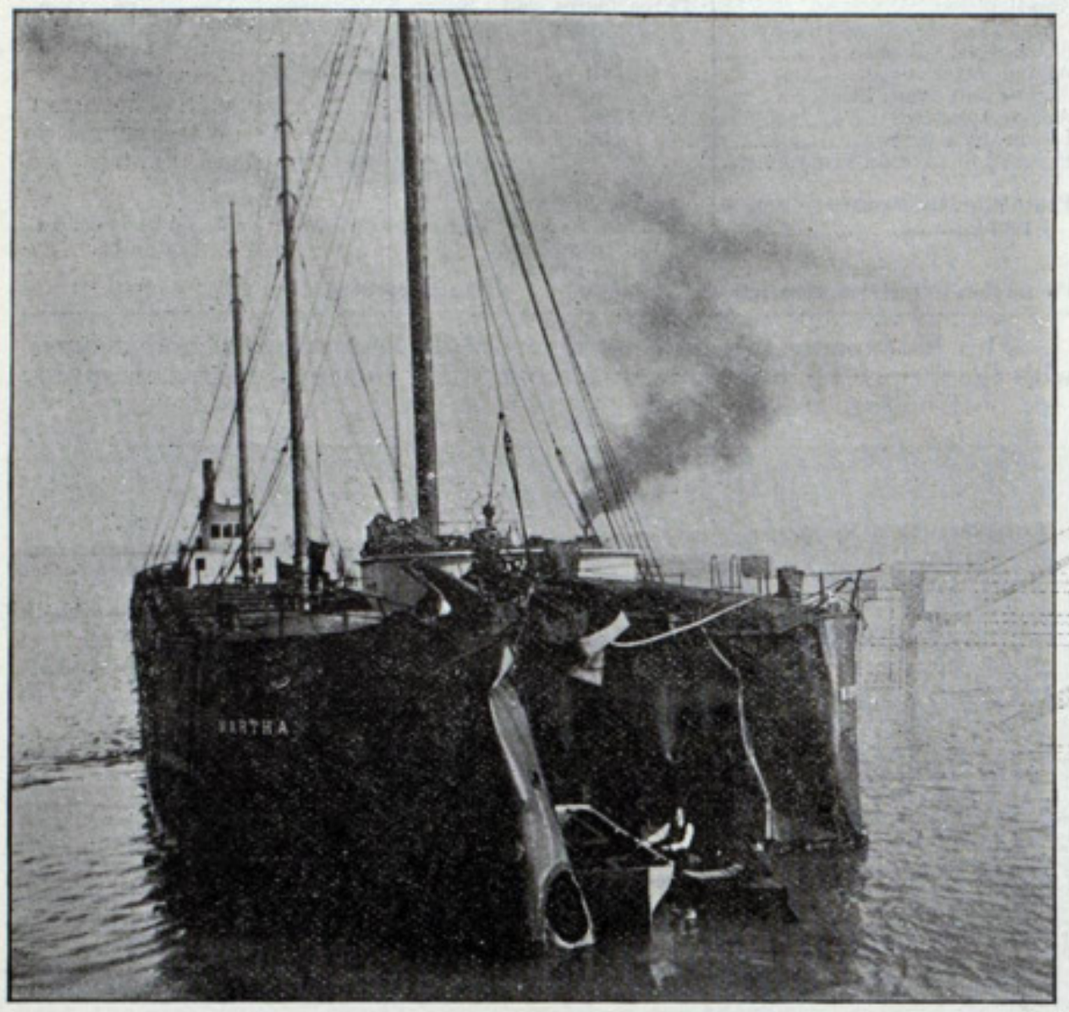
QUADRUPLE EXPANSION ENGINES OF FAST TWIN-SCREW YACHT ARROW.

sets of quadruple expansion engines for propelling the boat (each of which is fitted with a steam reversing engine) two engines for driving the blowers for supplying ventilation and forced draft; an electric light engine and dynamo; two circulating engines for pumping the injection water for the condenser; duplex bilge and fire pumps; an auxiliary air pump for supplying a vacuum when the air pumps attached to the main engines are not running; a distiller pump and two evaporators and distillers of sufficient capacity to supply fresh water for the entire boat service. In addition to these are the steam steering engines and auxiliary feed pumps for the boiler room, and two feed water heaters and condensers.

The hull has been constructed at the ship yard of Samuel Ayers & Son of Nyack, N. Y., who also built the Ellide and a number of other fast boats from Mr. Mosher's designs. It is all ready to receive the machinery. The boilers are nearing completion at Lewis Nixon's Crescent Ship Yard, Elizabethport, N. J., having already successfully withstood all tests. The main engines and all auxiliaries have been constructed by the L. Wright Machine Works, Newark, N. J., Mrs. W. R. Sands acting in the capacity of inspector for Mr. Flint. The boat and machinery have been designed in every part and detail by Mr. Mosher, and it is safe to predict that the performance of this latest product of his genius and skill will surpass his past notable achievements in this line.

A SMASHUP ON LAKE ST. CLAIR.

Of all the smashups that have ever resulted from collision on the great lakes that of the steel barge Martha, shown in the accompanying illustration, is the worst. The Martha was bound down Lake St. Clair at Grosse point at 10 o'clock at night, Oct. 26, loaded with iron ore, in tow of the steamer Mariposa when she was struck and sunk in the shallow water of that vicinity by the steamer E. P. Wilbur, bound up with a cargo of general merchandise. The force of collision was so great that ore from the hold of the barge was thrown up on deck. It is useless to discuss the cause of the collision, as there are no definite statements from



the crews of either vessel. On the part of the sunken vessel it is claimed that the Wilbur was running at a very high rate of speed, racing with the steamer Troy. It is certainly strange that the Wilbur escaped without great injury. A large number of plates in her bow are of course damaged, and repairs may require an expenditure of probably $10,000, but aside from damage to forward plating, the bow of the Wilbur is not at all like that of a ship that had suffered such great shock of collision. The Wilbur is owned by the Lehigh Valley Transportation Co. of Buffalo and the Martha by the Minnesota Steamship Co. of Cleveland. The latter company has a large fleet of steel vessels that have not been insured this year, and unfortunately their losses have been very heavy. The photograph from which the illustration was made was furnished to the Review by Charles T. Benham of Detroit.

FOULING OF SHIPS.

A very interesting and valuable paper on this subject was recently presented before the North-East Coast Institution of Engineers and Ship Builders in England by Mr. W. H. Atherton.

Mr. Atherton first examines the conditions under which fouling takes place; all being understood to occur in sea water. The favorable conditions are as follows: Lying at anchor in shallow water; roughness of ship's bottom; high temperature, such as in tropical waters; local circumstances, certain ports appearing to be especially alive with fouling germs. These are all circumstances which favor rapid fouling, but it goes on to a greater or less rapid extent in all salt water, and so is a matter of concern everywhere.

The principal effect of fouling of a ship is an enormous increase of the resistance experienced by the ship in its passage through the water; causing a loss of speed, and also in the case of a steamship, great waste of coal. By fouling, the coefficient of friction is quite commonly doubled; and ships occasionally become so foul that the skin friction mounts up to four times its value for a clean bottom. The effect of fouling is very clearly shown by the comparative speed curves for the same ship with clean and with foul bottom. When it is understood that the power varies approximately as the cube of the speed, it will be seen what a waste is involved. Taking the case of a vessel capable of making 12 knots with 2,000 H. P., when clean, at 80 revolutions, she may be able to make only 9 knots when foul, this requiring about 1,500 H. P. Since the power required to drive the ship at 9 knots, when clean, will be only about 844 H. P., there is 44 per cent. wasted in overcoming the extra resistance.

The best remedy, and indeed the only real remedy, against fouling is copper sheathing. This was extensively used upon wooden ships before the advent of iron and steel construction, but in the latter case a new difficulty appears in the form of galvanic action between the copper and the iron, and consequent corrosion and destruction of the iron. The only manner in which this action can be prevented is to insulate the copper from the hull by an intermediate wood backing, this adding greatly to the expense. Attempts to electro-plate the copper directly upon the plates of the ship have been found objectionable because of this corrosion, and although it has been found entirely practicable to coat the hull with a continuous shell of copper, the excessive corrosion of the steel makes this method valueless. When a copper sheathing is properly insulated it certainly prevents, to a great extent, the fouling of a hull, but there are various theories as to the manner in which it acts. The most reasonable explanation lies in the fact that copper exfoliates, or oxidizes in thin parallel layers, and these very thin layers are gradually shed off, and with them come the animal or vegetable substances which have attached themselves. The chemical, or dissolving theory, which is often confused with the preceding, assumes that there is a continuous formation of a soluble oxychloride of copper which washes off, carrying with it any fouling growths. Besides these there is the biological theory, which assumes that the formation of poisonous salts of copper kills the lower animal and vegetable growths, and prevents their adherence. No one of these theories has been positively demonstrated or disproved, and while the weight of opinion inclines toward the exfoliation theory, it is highly probable that all three actions take place in a greater or lesser degree at the same time. Zinc has been suggested as an anti-fouling sheathing, and it possesses the great advange of being electro-positive to iron, therefore protecting the latter from corrosion. The zinc, however, is very rapidly corroded itself, and becomes very rough, unless it is insulated from the iron, in which case it lasts much longer, but is proportionally less effective as an anti-fouler.

The high cost of copper sheathing has caused many attempts to be made to find a satisfactory substitute, and by far the greater number of vessels depend for protection upon some kind of anti-fouling paint or composition. Such compositions, while not as effective as copper, serve their purpose fairly well, the vessels being docked and repainted once or twice a year. From the composition of these coatings it appears that the poisoning theory is mainly held by their compounders, since the principal ingredients are a solution of gum, shellac, or rosin in spirits of wine, naphtha, or other solvent, to which, in addition to a coloring pigment, there is added a salt of copper, zinc, arsenic or mercury. The varnish or other medium is purposely made so as to be slowly soluble in sea water, allowing the action of the contained salts to progress gradually for about a year. The value of such coatings depends largely upon the manner in which they are applied, and care should be taken to have the hull well cleaned and painted with a rust preventive. The anti-fouling composition should be applied in one coat and kept well mixed, to prevent the metallic salts from separating out, if the best results are to be secured. The whole subject is one which would well repay a systematic and scientific investigation, and Mr. Atherton suggests that such a study should be made by a special commission, no one man being fully qualified for the task.

MINE OF TUNGSTEN IN CONNECTICUT.

The New York Tribune of recent date contains an interesting article of a discovery of rare minerals which are being mined at Long Hill, eight miles north of Bridgeport, Conn., and which are being used by the United States government in a series of experiments to find a projectile that will pierce the heaviest and hardest armor plate. The products of this mine are wolfram and scheelite, the two being found in combination so far nowhere else in the world. They are, however, found separately —the scheelite being found in the gold mines of New Zealand, but it does not equal either in quantity or quality that which is being mined at Long Hill from the Shaganowaump mountain. Wolfram is found in small quantities in Utah, Arizona, and in the tin mines of Cornwall, England. This combination makes the value of the mine extremely great. Wolfram and scheelite are the ores of tungsten. At the present time the products of the mine sell from $450 to $650 a ton, and the owners of this mine control the world's market for tungsten.

The American Tungsten Mining & Milling Co. was formed a little over a year ago, and has been working the mine since September and erecting a plant. Among those interested in the mine are Frederick C. Beach, editor of the Scientific American, who spends his summers at Stratford, a suburb of Bridgeport; Sir Douglas Fox of London, a well known authority on mining in Cornwall, England; W. H. Hinsdale, who designed the unique plant, and who has been identified with the manufacturing of steel for years; and Professor Adolph Gurlt of Bonn University, Germany, the chief consulting engineer, who has made several trips to this country for the purpose of shaping the development of the mine. The resident chemist is Professor Herbert Shilstone, late of Barbadoes, British West Indies, and the resident engineer is Earl C. Bacon. Mr. Shilstone is one of half a dozen chemists in the world who have analyzed or who know practically anything about wolfram or scheelite.

Some sixty years ago the discovery of the combination of the minerals here was made, the fact appearing in a book published in 1837 by Dr. E. U. Shepard, on the geology of Connecticut. Scientific men give as the explanation for the deposit the fact that Shaganowaump mountain was once a volcano, and that while the eruption of the volcano was in progress the chemical changes superinduced by the intense heat took place and left in layers about the hill limestone as the first stratum and underneath the limestone the combination layer of wolfram and scheelite. While the volcano was in action the tungstic acid acting on the limestone produced scheelite and on the iron ore produced the wolfram.

At the present time the mining being done is simply surface mining. Thus far the layer of limestone, which is next the surface, is not so thick as to prevent removing it and mining in the open-cut fashion. The strata of limestone is about ten feet thick and will increase in thickness as the mining approaches the crater of the volcano. When the limestone grows too thick to cut through it will be tunneled under. The vein of scheelite and wolfram which is now being worked is from twelve to fifteen feet thick and apparently of unlimited width. The progress of the development of the mine is to work toward the crater of the volcano. When the crater is reached a vertical shaft will be sunk, for then the yield of wolfram and scheelite is expected to be much larger. The spot from which the ore is now being taken is about half a mile from the plant where it is crushed. The building is on the side of the hill, six stories high. The ore is practically pulverized and then passes through Hooper separators and the valuable ore is taken out of the tailings. The American Tungsten Mining & Milling Co. does not separate the wolfram from the scheelite. It is shipped to buyers as it comes from the separators. But the two can be readily separated by the use of the magnet, as wolfram responds to the magnet and scheelite does not. The Krupp Steel Works of Germany, have taken nearly all of the output thus far. A month ago, however, a large consignment was sent to an experiment station of the United States government, and recently it was demonstrated that a projectile with a tungsten jacket made from wolfram and scheelite would penetrate the hardest kind of harveyized nickel steel armor.

ESSEX CLASS OF CRUISERS.

At present considerable interest obtains in the construction of cruisers—four nations having under construction or in contemplation a type of vessel which may be regarded as of the same class. These are the Essex class of the British navy, the Bayan class of the Russian navy, of which the Variag is one; the Prince Heinrich class of the German navy, and the three protected cruisers provided for in the last naval bill of congress. The four armored cruisers of the Essex class—Essex, Kent, Bedford and Monmouth—although a great deal heavier than the Bayan and Prince Heinrich, are essentially of the same type. The principal particulars of the type are as follows:

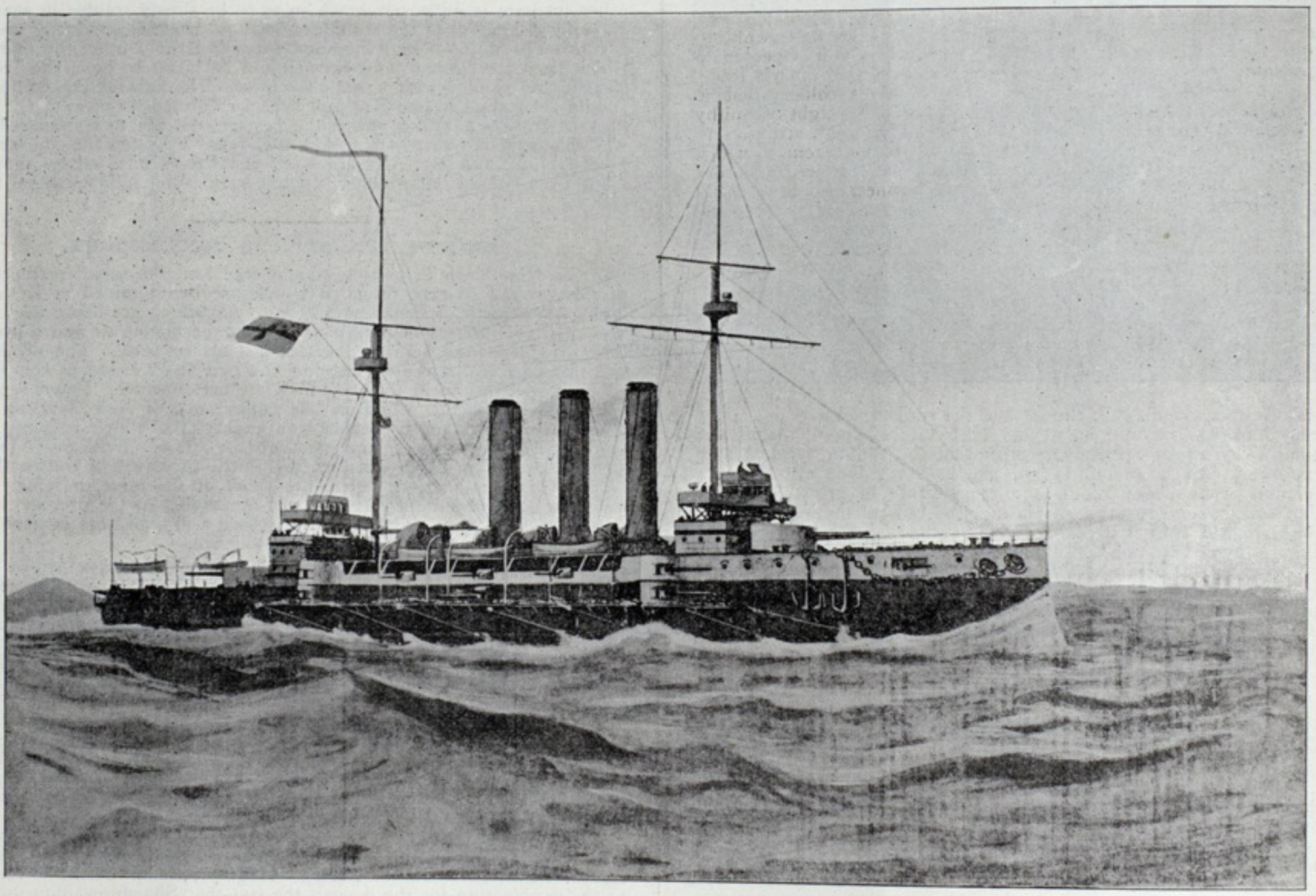
Displacement .....9,800 tons
Length .....440 ft.
Beam .....66 ft.
Draught—mean .....24½ ft.
Armament—Fourteen 6-in., 45 calibre; ten 12-pounders, three 3-pounders, and an indefinite number of Maxims, probably eight
Torpedo tubes .....Two 18-in. submerged

The Essex has the high forecastle common to all cruisers of the British navy nowadays and her 12-pounder battery is amidships. The high forecastle is absolutely indispensible to a swift cruiser—otherwise they take in too much sea forward. The 6-in. guns are thus disposed: Two in a turret forward, two in a turret aft, six on the main deck amidships and four on the upper deck above the forward and after main deck guns. All these pieces are in armored casements. Six 12-pounders are on the upper deck amidships, two under the forecastle forward, two on the main deck aft. This is the armament of the Essex in the original design, though there are rumors about installing a 7¼-in. quick-firer. All fourteen 6-in. guns are protected. The armor of the Essex is thin and extensive. There is a belt about 250 ft. long amidships of 4-in. Krupp cemented armor and this belt extends right up to the main deck. It is continued to the bow at a thickness of 2-in. Aft it is terminated by a 5-in. bulkhead. A curved protective deck runs throughout the length of the ship and reinforces the water line protection. The space above and below is filled as usual with coal bunkers. The casements are 4 in. thick, the turrets 5 in., but for these nickel armor, not Krupp, is employed. It has less resisting power, but is more easily worked. These turrets have short armored bases of 5 in. thickness with armored hoists going down the main deck. These turrets are distinctive and, so far, peculiar to the Essex class. To begin with the guns in each can be trained together and fired as one piece or else used independently. These guns and their mountings are to be furnished by Vickers, Sons & Maxim., Ltd., who have brought out the design. There is a single hoist to a pair of guns worked by an electric motor. It serves with very great rapidity and when in full working order delivers every alternate charge to the port gun, which has a special small motor to catch it as it comes up the endless chain. This arrangement can be easily disconnected—the hoist is then made to serve one gun only.

The Essex will have the usual rig for modern British cruisers, a search light platform on each top, but no fighting tops for guns. There will be three funnels. The engines are designed to give 23 knots speed with 22,000 H.P. The boilers will be Belleville of the latest pattern fitted with economizers. Comparing the Essex with the Bayan and Prince Heinrich as regards powers of offense and defense the following is found:

	Essex.	Bayan.	Prince Heinrich.
Displacement	9,800	7,800	8,868
Horse-power	22,000	17,000	15,000
Speed (maximum,) knots	23	21	20
Main Armament	Nil	Two 8in.	Two 9.4in.
Secondary armament	Fourteen 6in.	Eight 6in.	Ten 6-in.
Tertiary " (protected)	Nil	Eight 3in.	Nil
Tertiary " (unprotected)	Ten 3in.	Twelve 3in.	Nil
Small pieces	Three 3-pdrs. and Maxims.	Seven 3-pounders.	Ten 1-pdrs., four Maxims.
Submerged tubes	Two	Two	Three
Above-water tubes	Nil	Three (2 protected)	One
Armor belt (amidships)	4in.	8in.	4in.
Armor belt (bow)	2in.	4in.	3in.
Lower-deck armor	4in.	3in.	4in.
Protection to main armament		7in. on each turret; 3in. hoists to these.	6in.
Protection to secondary armament	Four 6in. in turrets with 5in. armor. Ten 6in. in casem'ts with 4in. armor.	3in. on 3 redoubts.	6in. on turrets and redoubt.
Protection to tertiary armam't.	Nil	3in. on eight of them	Nil

The Essex may therefore be regarded as first in speed and defense with the Prince Heinrich first in offense. The Bayan is second in speed, though whether this advantage will be maintained in actual service is questionable, as the Russians are not strong in their engineering department. The American contribution to the Bayan type, the Variag, is, however, the fastest cruiser afloat.



THE BRITISH CRUISER ESSEX.

LANSDOWNE HELD SOLELY TO BLAME.

As noted in the last issue of the Review, the libel cases growing out of the collision of the steamer W. B. Morley and the car ferry Lansdowne in the Detroit river on Aug. 6, 1899, involving $74,438 in damages, were brought to a conclusion in the United States district court at Detroit last Saturday, Judge Swan deciding against the Lansdowne, dismissing the cross libel filed by the Grand Trunk against the Wabash railroad, and holding the ferry solely to blame for the loss. The finding of the court, which was not given out when a mere announcement of the decision was made a week ago, instructs Commissioner Davison to examine into the amount of damages, and by stipulation of the attorneys of the two companies, to divide the amount equally between the Grand Trunk railway and Wabash railway companies. The libel filed by Charles T. Morley and others, owners of the Morley, was for $43,556.50, damages to steamer, salvage and loss of cargo. The Wabash filed a cross claim of $1,000 for demurrage on cars delayed by the accident and the Grand Trunk claimed $29,882.56, asking the court, in case damages were found against the boat, to levy the entire item against the Wabash company, which used the ferry under a contract by which it agreed to assume any damage sustained while the steamer was used by the Wabash. The decision was based upon the failure to show that the port light of the Lansdowne was properly exposed.

IMPORTATION OF STEEL INTO GREAT BRITAIN.

The importation of steel into England is viewed variously in the English technical press. Some take a sober view of it and others are inclined to scoff. The item of news sent out from Pittsburg that Carnegie had chartered three or four vessels to carry steel direct from the Great Lakes to England has received the most attention. These vessels, which were brought here from England during the early summer, when freights were high on the lakes, are now going back for the winter and must have some cargo, so it is convenient for them to take the steel at a lake port, but after the inconsequential manner of their kind the daily newspapers magnified this item out of all proportion to its importance; and caused Syren & Shipping of London to take the following view of the case:

"'Carnegie tolls the knell of parting day,' in so far as Britain's commercial supremacy is concerned. Mr. Andrew Carnegie, to be more explicit; although, on inquiry, we find that he merely 'intends' doing so by running steamers of his own so that he will be in a position to underbid the world in the matter of steel selling. What the mere possession of an insignificant—for even to a man of Mr. Carnegie's wealth, anything he may be able to achieve in the steamship line must, of necessity, be an insignificant affair, when nationally considered—fleet of steamers is likely to do in upsetting existing conditions, is difficult to understand; but, of course, it must be all right if Mr. Carnegie says so. Anyhow, it is stated that the Carnegie company is about to open a transatlantic freight service on Nov. 5, whence, for ever afterward, they will be able to underbid the world in the matter of steel. Underbid, you'll observe; not undersell, which is altogether another matter. But, after all, the whole thing emanates from a 'dispatch from Pittsburg,' so perhaps we had better wait awhile to see what really is to be done. For the Pittsburg iron works people to start shipowning for the purpose of smashing up a rival country's trade, reminds us of the village blacksmith who tried to buy a colliery that he might be independent of coal prices for his two hundred weight of smithy coal per week. It will certainly need more than four small steamers to smash up Britain's mercantile supremacy, and this is the extent to which the Carnegie company means to go because they have secured an order for 4,000 tons of steel for Liverpool! Most sane business people wouldn't lose their heads if the order happened to be—in their case—4,000,000 tons! Each Carnegie steamer is to be entrusted with 1,000 tons of good Pittsburg steel, which is to be then covered over with 1,500 tons of wood pulp, before starting for Liverpool—the pulp is probably meant to keep the steel from swelling out of the hatches, when it remembers what great things it is to pioneer."

Fairplay, however, looks at the situation in a much more business-like manner and seems to see, under present conditions, a market for American steel in the foreign field and the colonies which have hitherto been the exclusive property of Great Britain. Fairplay says:

"Few people are aware of the extent to which American steel is being ordered from this country, chiefly for Belfast and the Clyde for ship building, and for London and the Midlands for bridge building. I know of one firm that has sold for delivery in the United Kingdom between 50,000 and 60,000 tons of American steel for these purposes. Were it not for the abnormally high freights from America now ruling, a considerably larger business would undoubtedly have been carried through. Freights from America are double the usual rate. The Belgian and German prices also are at present a long way below those of British makers for bar iron and steel, and export orders for India and China, as well as for our colonies, are going largely to these markets, as well as to America. Naturally America, which so easily competes with us in this country, finds it a much simpler thing to meet us in the foreign and colonial markets. The high price of coal, of course, is a very important factor in this competition. In America the coal used for the purpose of making steel is round about 4 shillings a ton; here it is 17 shillings a ton, and as it takes from two to two and a half tons to make a ton of steel, it will be understood where the handicap comes in in favor of America. It is not only in the price of steel that this high charge for coal acts so much against our interest, but in every industry in the country which is dependent upon coal, and which is in competition with other nations."

VAST NAVAL PROGRAM CONTEMPLATED.

Press dispatches from Washington indicate that the navy department contemplates a vaster program for the increase of the navy than ever before. The program as outlined involves the construction of not less than forty warships, including various special types not hitherto built for naval purposes. The program, as reported, will include no less than six ships of the heaviest armor and most destructive ordnance, with the highest practical speed, the greatest attainable radius of action upon a displacement of about 15,000 tons combining the most desirable features of line-of-battle ships and cruisers. At least twenty gunboats are proposed of several types, all of light draught, with large rapid-fire batteries and accommodations to give comfort to officers and crews stationed in the tropics. All of these gunboats will be able to go out to Manila and then if necessary to Chinese interior ports, under their own steam. Provision is made in the program for an increase in the torpedo flotilla by ten new vessels, including a new type of torpedo cruiser on the lines of existing torpedo boat destroyers, which can accompany a fleet of battleships across the ocean. Several of the other new vessels in this category are to be submarine, if success attends the improved Holland boats now under contract. The program will also include three armed colliers, larger than any vessels of this class ever built for a government. They are to have enormous capacity, enabling each of them to deliver 10,000 tons of coal to Manila, Guam or Pago Pago. A large unarmed ship, which is recommended, is a floating machine shop of about 6,000 tons displacement, for duty in repairing naval vessels at great distances from government yards, especially in the Philippines. Her design grows out of the experience with the Vulcan at Guantanamo, when that vessel obviated the necessity of withdrawing half the fleet from the Santiago blockade.

John A. Ubsdell, Jr., who succeeded W. I. Babcock as manager of the Chicago Ship Building Co., Chicago, is the son of John A. Ubsdell so long in charge of the jetties at the mouth of the Mississippi. Manager Ubsdell is a graduate of the Troy (N. Y.) Polytechnic School, and has been with the Chicago company for ten years.—Marine Journal.

WIRELESS TELEGRAPHY IN GERMANY.

The first wireless telegraphy connection in Germany between a light-ship and a light-house, itself connected by cable with the mainland, has been established by the North German Lloyd on the Borkum light-ship. The island of Borkum lies in front of the Dollart bay, into which the River Ems empties itself. The Borkum Riff light-ship lies 21 miles further out in the North Sea, in the navigable channel of the ocean boats. A signal mast, 125 ft. high, was erected near the light-house; and the middle mast of the light-ship was continued by a yard 33 ft. high. This was done in February last, but a gale brought the yard down, and the repair had to be postponed till May. The antenna (or air wire) on Borkum island consisted originally of two parallel wires. As the service was not satisfactory, a belt of wire netting, comprising two cables, each of seven strands, 65 ft. long and 3 ft. wide, has been fixed between a yard on the mast and the light-house tower. The antenna of the lightship has a length of 100 ft. The instruments were supplied by the Wireless Telegraph Co. They consist of Obach dry cells, transmitter with key, and a receiver with jigger. The radiator is a Ruhmkorff apparatus, the secondary terminals being spheres, 1.2 in. in diameter. The one terminal is earthed, the other connected with the air wire. They key consists of two lever arms, joined at an obtuse angle. The front arm is of brass, and bears a platinum contact, by means of which the battery current for the primary coil is closed. The rear arm is, like the handle, of ebonite, and pierced by a contact pin, connected above with the air wire by a spiral, and fitting below, when depressed, into the rest contact, which establishes connection with the receiver. This receiver comprises a jigger, consisting of a primary coil and two secondaries, between the ends of which the coherer is placed. The coherer is of the ordinary type, but its sensitiveness is adjustable. The two silver terminals have between them a gap of wedge shape, about 1 millimetre wide, filled with filings of silver and nickel. The highest sensitiveness is obtained, according to the description which M. Minolts gives in the "Elektrotechnische Zeitschrift," when the filings are crowded in the narrow part of the gap, and the sensitiveness can be diminished by turning the tube about its longitudinal axis. The tapping is effected by means of an ordinary bell armature. A number of shunts are provided to protect the coherer against the spark radiations, produced in the receiver, while the whole receiver is encased in metal, not to be disturbed by the electric waves coming from the induction apparatus of its transmitter. The service has been regular since the middle of May and is described as satisfactory, on the whole, and very good occasionally. In February last, that is, before the installation on the light-ship had been put up, the light-house exchanged messages with the Kaiser Wilhelm der Grosse when the steamer was 35 sea miles off.

AMERICAN AND BRITISH IRON.

H. J. Skelton, writing in the Engineering Magazine, says: "So far as figures go, America will doubtless remain for some years to come the largest producer of iron and steel. But something more than quantity and cheapness of product is required, and that is that these things shall be obtained with a general well-being on the part of the workers engaged. American mechanical genius and cheap steel will not only raise the standards of comfort, but will multiply the wants of civilized mankind, which consumes more iron per head of population year by year. But in seeking to create and sustain an export trade in steel, America will find Belgium and Germany her most formidable competitors—particularly Germany, whose manufacturers thoroughly understand the art of combination to insure immunity from external competition.

"American competition will be more successful in British colonies, dependencies and in neutral markets generally than in Great Britain itself, where it will act as a health-producing tonic that England has wanted for many a day. The supply of skilled and industrious workers in British industries has usually been ample. The skill and capacity of the better-class individual English worker is on the whole to-day in the iron, steel, engineering and allied trades not inferior to the skill and capacity of the worker in any other nation. But while the best brains of America have been devoted to the honorable pursuit of industry, to develop mechanical ingenuity, to guiding, governing and giving all those general advantages which a trained intelligence confers, such has not been the case in England. There were in England not only conditions of luxury and ease, but social ideas, hindering trained and organized manufacturing development.

"On the engineering side I am doubtful of the ability of American steel masters to displace the use of British steel in structural work, where American suppliers claim a limit of phosphorus in their steel of .10, while British masters, in the open-hearth acid process, habitually work to a limit of .06. Every engineer knows that the lower phosphorus gives a better steel, safer in use, and will insist upon having low phosphorus while he can get it. The tendency and the practice among English engineers is rather to raise the standard of quality than otherwise. Too much has been said, or presumed, as to the inferiority of British iron masters in blast-furnace practice. It is true that the output from particular American furnaces working rich ores is superior in tonnage to British practice working on ores with a lower content of metallic iron. But figures that have come before me from time to time show that in the best practice the 'yields are good, and that pig iron is constantly being made in England with no higher consumption of coke per ton of pig produced than obtains in best American practice. There is at least one district in England, working on English ore, in which, under normal conditions, structural steel can be produced at as low a cost as any figures at present obtained in America, while if the close contiguity of coal to the Lincolnshire iron field, which of late seems assured, is taken advantage of there will be British iron and steel masters capable of holding their own against all comers."

Messrs. F. Leyland & Co. of Liverpool have placed an order with a Dundee firm for a steamer of the following dimensions: Length, 460 ft.; beam, 53.6 ft.; depth of hold, 34.8 ft. She will be of 9,000 tons measurement cargo and will accommodate some first-class passengers.

Russia is to build five torpedo boats of the French Cyclone and American Dahlgren type. These boats, with a displacement of less than 150 tons and a speed of 30 knots an hour, are the fastest of their class or type in the world.

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The present topic of discussion in Washington is the blunt manner in which Rear Admiral Melville takes issue with Secretary Long on the subject of the consolidation of the construction, engineering and equipment bureaus. It was supposed that as far as the present administration of the navy department is concerned the issue was a closed one. Secretary Long is pledged to the consolidation. In his annual report of last year he uses the following language: "In the opinion of the department it would be in the interest of good business organization and economy to consolidate the three bureaus of construction and repair, steam engineering and equipment under one head, the bureau of ships. These bureaus have to do with the construction and fitting out of vessels—in one word the material of the ship. It is an integral work. When a contract is made for the construction of a ship it is made with one builder. It is not given part to a constructor of hulls, part to a steam engine manufacturer, and part to an outfitting firm. Whatever various trades enter into the work are all under one head. This is the method of private ship yards which build the largest ships and which are not left to the administration of three heads between whom delicate questions of respective authority and responsibility are liable to arise, resulting in delays, and too often in friction and lack of harmony of co-operation. Each of the above bureaus has now, during the construction of naval vessels, its separate inspector at each yard. A consolidated bureau could, of course, be run much cheaper than three bureaus and a great saving made by a reduction of the now three separate working forces, both clerical and mechanical, especially in our navy yards. Fewer naval officers would be needed, as there would be but one staff, instead of three, so that more officers would be available for other duty. Under the present system one bureau brings its work to the point of readiness for the work of another, which is not always ready for it. There is necessarily a lack of that adaptation and harmony of movement which one head would secure."

This is the argument which Melville calls fallacious and which if followed out would result in "confusion and greatly decreased efficiency." The admiral, however, makes no mention of the added labor of inspection at each of the yards. The fact of the matter is that the utmost jealousy exists among the attaches of the various departments. One will not permit the other to encroach upon his domain in the slightest degree. It is curious to analyze the sources whence each derives its authority. The bureau of equipment furnishes coal to the navy. Why? Because in the old days when wind was the motive power it furnished the sails. All electrical apparatus is bought by the equipment department. Why? Because before the days of the incandescent light it supplied the ships with candles and later with oil. The great body of the electrical plant of a warship is a part of her structural outfit. Therefore why does it not properly belong in the construction department? It has machinery, too, in the shape of dynamos. Therefore why does it not properly belong in the engineering department? Numerous other incongruities might be mentioned. There is no indication that Secretary Long has changed his mind that all these departments with their overlapping ramifications are legitimately under one head.

Bristol and the West Indies are to be brought together again. The Elder-Dempster Steamship Co. is to start a regular service between England and Jamaica, and in consideration of receiving an annual subsidy is to bring back to England 40,000 bunches of bananas on each trip. This means, of course, that they will have to engage in the business of raising bananas. It is a direct attempt on the part of the British empire to assist one of its colonies. Curious as it may seem trade with the West Indies was greater 200 years ago than it is now. There was a great interchange at that time between Bristol and Jamaica, but the system of foreign bounties on sugar killed it utterly. The steamship company is making a legitimate effort to revive the trade and has offered prizes for suggestions. In this connection it is interesting to note that the cable just brings the information that the town council of Bristol, after years of controversy, has resolved to ask parliament for permission to construct a dock at Avonmouth to accommodate the largest ocean-going steamers in the world. The cost of the improvement will be £1,804,000. As Syren & Shipping recently remarked, the geographical location of Bristol is excellent but one cannot land bananas on a geographical location. A quay is much more useful. The ambition of Bristol is to be restored to its former position as second to Liverpool. Bristol had that proud honor once.

Possibly on the eve of election it may not be amiss to say a word anent the issue. There is no use disguising it with a wealth of phrase—the real issue is not imperialism but silver. There is a much beclouded view of a question which ought to be as clear as sunlight. It was the old legal tender law of thirty years ago which created the impression that money does not derive its usefulness from its own value but from the fiat of the government upon it. This is the delusion upon which the silverites have based their cause. If the stamp of the government gives a real value then it is wasteful to use silver when paper would do as well; if the metals circulate for their own value then it is manifestly impossible that both a gold piece and a silver piece should pass current for a dollar when one metal is worth twice as much as the other. The value of the legal tender notes lay in the ability of the government to redeem them. No sane person believes that the republic stands in any danger of imperialism. It is the merest kind of a scarecrow. No, no, the real issue is the financial honor of the country. It is upon that foundation that the commercial prosperity of the country lies.

Advices have been received from Washington to the effect that Col. Jared A. Smith of the United States army engineer corps, stationed at Cleveland, is to be transferred to San Francisco on Nov. 23. He will be succeeded by Col. Samuel W. Mansfield. There is no vessel owner in Cleveland who does not wish Col. Smith a pleasant and successful career in his new post. Everyone hopes that San Francisco may be, in every way, congenial to him.

THE DANISH MERCANTILE MARINE.

From Fairplay, London.

From the particulars published by the Danish Statistical bureau we find that at the beginning of the present year the mercantile marine of Denmark comprised 3,844 vessels of over four tons register, measuring altogether 423,549 register tons net. Of this total 3,305 were sailing vessels, measuring 165,308 tons, and 539 were steamers, measuring 258,241 tons. The Faröe Islands, however, were the home of ninety-four ships (4,879 tons), Iceland of 159 (7,757 tons), and the Danish West Indies of forty-seven (444 tons); so that the merchant navy of Denmark proper consisted of 3,544 vessels, measuring 410,469 register tons net, 3,047 being sailers with 155,271 tons and 497 being steamers with 255,198 tons and 53,107 I.H.P. Of the steamers 463 were screw and thirty-four paddle boats, and 389 of them were engaged in the cargo and passenger trade. In the last four years—that is, since the end of 1895—the sailing fleet has been increased by thirty-seven ships, but its tonnage has been reduced by about 13 per cent. During the year 1899 eighty-five sailing ships of 4,109 tons altogether (all sailing ships of more than four tons being registered) were built on Danish account at Danish yards, besides which forty-five (3,271 tons) were acquired from abroad, so that 130 sailers with 7,380 tons were added to the list. Against this, however, there is to be set a falling out from the register of 114 ships and 10,138 tons—forty-six sailers (4,720 tons) having been lost, fifty-nine (5,193 tons) sold to foreigners, and nine (225 tons) broken up. Svendborg is the port at which the largest amount of sailing tonnage was registered, viz., 991 tons; Elsinore follows with 723 tons, Copenhagen with 638, and Rönne with 605 tons, and so on.

The Danish mercantile steam fleet was increased last year by twenty-one vessels and 32,064 tons, or 14½ per cent. In the last four years the increase amounts to ninety-six vessels and 111,139 register tons, or a little over 77 per cent. The increase has been constant from year to year, and the average capacity per steamer has risen from 110 tons in 1867, to 258 tons in 1880, 341 tons in 1889, and 565 tons in 1899. In the course of the year eight steamers (5,034 tons) were built in Denmark on Danish account and thirty-six (35,117 tons) were acquired from foreigners, but twenty-three having been removed from the register the net increase was twenty-one.

In the official statistics the vessels are divided into three categories, viz. (1) coasting vessels up to 50 tons, (2) medium-sized vessels from 50 up to 300 tons, and (3) large vessels of more than 300 tons. If we compare the three categories with the lists of the year 1895, we find that the coasting vessels have increased by 181 and 2,400 tons, the medium-sized vessels are less by ninety-six and 14,000 tons, and the large vessels are more by forty-eight and nearly 100,000 tons. Of vessels measuring more than 1,000 tons, the Danish merchant navy at the end of last year included 100, viz., twelve sailers (13,650 tons) and eighty-eight steamers (140,653 tons). Of the large sailers seven belonged to Fanö, three to Copenhagen, one to Elsinore, and one to Skelskjör, while of the large steamers eighty-five belonged to Copenhagen, and one each to Aalborg, Elsinore and Aarhuus. Of the whole amount of tonnage, 58 per cent., or 576 vessels with 237,000 tons, belonged to Copenhagen; to Fanö 37,170 tons, to Marstal 25,645 tons, to Svendborg 20,257 tons, to Esbjerg 10,856 tons, to Aalborg 5,615 tons, to Rönne 5,599 tons, to Aarhuus 4,806 tons, to Elsinore 4,608 tons, to Korsör 4,053 tons, etc. The largest Danish steamship owner is the United Steamship Co. of Copenhagen, which possesses 137 steamers of 178,651 tons register and 19,991 H.P., but of these only ninety-three vessels of 68,493 tons and 15,380 H.P. are registered at Copenhagen.

Mr. Joseph Gilchrist of Cleveland, who has placed an order with the American Ship Building Co. for eight steel freight steamers of 5,000 gross tons capacity each, says: "I am repeatedly asked why I did not build 500-footers—vessels of more than 7,000 gross tons capacity. The 5,000-ton boat is the better business boat for the so-called 'outsiders' like myself. We must carry coal, grain, ore, as freights may offer, going to all kinds. If we were engaged regularly in the ore trade, then the larger vessel would be the kind to build.

Men aboard lake vessels will soon be going to their homes for the winter. Arrange for change in address of your Marine Review before quitting ship.

GERMAN ENTERPRISE.

PLANNING A REARRANGEMENT OF SHIP SUBSIDIES SO AS TO CAPTURE SOUTH AFRICAN TRADE—NO OBJECTION TO LEGISLATION THAT PROVIDES FOR EXTENSION OF GERMAN COMMERCE.

It is very evident that the Germans intend to push their trade in every market of the world, and for this purpose they are developing their mercantile marine and their navy as quickly as possible. We have from time to time noted the extension of their operations in the far east and Australia; these are regulated by the law of April 13, 1898, which provided, for a term of fifteen years, for the new circumstances which had arisen in consequence of the development of traffic. A short time since a bill for extending the subsidized mail services to South Africa was introduced into the reichstag, and was accepted in its entirety on the third reading without any debate, showing that there is a consensus of opinion among all classes of the German population as to the importance of opening wider fields for German commercial enterprise in South Africa. Those in charge of the measure urged that it was advisable to establish African postal steamer communications as soon as possible, so that when the war in South Africa is over German enterprise may be well to the fore, and be able to take its fair share in the commercial development that will then take place. It was therefore arranged that the new contract should come into force on April 1, 1901. It was urged that all the reasons which were put forward at the time of the extension of the subsidized mail services with Asiatic and Australian ports, now apply with equal force to the question of extending the subsidized service to South Africa. Amongst them may be mentioned the fostering of the German trade in industrial products with foreign markets, the quickening of home production, and of merchant shipping, the freeing of German commerce from the agency of foreign nations, both as regards foreign business houses and in shipping matters, the avoidance of the damage resulting from transhipment, the providing of a passenger service affording all the comforts required at the present time on German ships and with German arrangements, and the possibility of transmitting mails independently of foreign countries.

In 1890 a law dealing with steamer communication to East Africa was passed in the interests of German trade and industry. By the contract effected in that year with the East African Steamship Co. the following service was established: A main line between Hamburg, Zanzibar, the chief harbors of the German East African protectorate and Delagoa bay, together with a coast service within the limits of the protectorate and of the Portuguese possessions. Ships on the main line were to run every four weeks. The company, however, soon extended its services beyond its contract obligations, and in 1892 prolonged the main communications as far as Durban. In connection with the East African Co., a weekly service between Bombay and Zanzibar was established. In 1896, the dispatch of vessels on the main line was made every three weeks, and since 1898 the service has been every fourteen days.

It was urged, in connection with the bill introduced in the reichstag, that, at the present time, when the old contract is about to expire with the East African line, it is important to secure in the new contract a maintenance of the present improved services voluntarily introduced by the company, and, further, that it was necessary that the speed of the ships should be increased so as to do the voyage to Zanzibar in the same time as the French Messageries Maritime. As regards the British company—the British India Steam Navigation Co.—running from Bombay via Aden to the East African coast as far as Delagoa bay, their rate of speed is still not so great as that of present ships of the German line. So long as this remains the case it will not be necessary to increase the rate of speed on that portion of the line. Moreover, it is considered necessary that the western portions of Africa should also be brought within the scope of the steamer communications from Germany.

The special reasons which were put forward for direct communication with the cape, apart from the advantage of generally extending German mail steamer services, are the following: 1. The economic importance of the Cape Colony for the development of German commerce. 2. The opening up of harbors of communication with the important territory of the Transvaal republic in addition to Delagoa bay. Conditions have changed considerably during the past few months, but they are rather likely to increase than lessen the desire of the Germans to extend their trade in the Transvaal. 3. The possibility of taking advantage at comparatively small cost of the economic advantages obtainable by a proper system of communication with Cape Colony by means of the East African Co. and of circular voyages right round Africa.

Until lately there was no direct connection with the Cape by German steamers, but about a year ago the German Australian Steamship Co. of Hamburg, which formerly called only at Port Elizabeth on the voyage to Australia, decided to call every four weeks at Cape Town on the outward voyage only. German trade with the cape lies, therefore, in British hands, and goes via London. The Union line sends its intermediate steamer every fourteen days to Hamburg to fetch the German consignments for Cape Town. In the interests of German commerce, it is important to have independent communications with the cape by means of a purely German steamer line, in order to be able to do without the transmitting agency of the United Kingdom. But besides this, there are also the interest of the German postal service and those of the imperial navy to be considered. Under the present steamer communications the German postoffice has to send all letters and parcels via London, to be carried on from there in British subsidized steamers to Cape Town. Moreover, in times of war the existence of a German company would afford greater security for the transport of the German mails. As was also urged, when the Asiatic and Australian services were established and extended in 1898, it is important also that in time of war the German navy should have direct German communication with the German empire.

Under the new arrangements it is not intended to enter into direct competition with the fast steamers of the Castle and Union lines, but the intention is to place the German ships on a par with the so-called "intermediate boats," which on the west coast of Africa travel at about 11 knots, and reach the cape in twenty-two days. A fortnightly service right round Africa would be established, starting alternately to the east through the Suez canal, and to the west by the Canary islands. The ports will be as follows: On the eastern voyage—Hamburg, Bremerhaven, Antwerp, Lisbon, Naples, Port Said, Suez, Aden, Tanga, Zanzibar, Dar-es-Salaam, Mozambique, Beira, Delagoa bay, Durban, East London, Port Elizabeth, Cape Town, Las Palmas, Lisbon, Bremerhaven and Hamburg. On the western voyage—Hamburg, Bremerhaven, Amsterdam, Lisbon, Las Palmas, Cape Town, Port Elizabeth, East London, Durban, Delagoa bay, Beira, Mozambique, Dar-es-Salaam, Zanzibar, Tanga, Aden, Suez, Port Said, Naples, Lisbon, Rotterdam, Bremerhaven and Hamburg. On the round voyages between Europe and the cape, the contract speed is to be 12 knots, both for ships already afloat and for the new vessels still to be built for the African services, when on the west coast of Africa. For the subsidiary lines the speed is to be 10½ knots on the longer and 10 knots on the merely coasting lines. The future traffic requirements will be: The two large steamers now ready, five new large steamers still to be built at a cost of £125,000 each, and four medium sized intermediate vessels costing each £65,000. For the carrying out of these services in the proposed extended form, the East African line is to receive an imperial subsidy of £67,500 per year, or £22,500 more than it now has under the existing contract; and the duration of the new agreement is to be for fifteen years.

The German consular reports from the cape have long called attention to the impetus to German trade that would result from a purely German line, as has happened in the case of American commerce from the time that the Americans established direct communications. The value of the total German exportation to the cape in 1898 is put at £735,800, that of importations thence at £980,000, and we expect a great increase when affairs are settled in South Africa and when the new German shipping arrangements are complete. It is advisable that British ship owners and merchants should make themselves acquainted with these arrangements and study their probable results.

STEEL BARGES FOR MISSISSIPPI.

THE ENTERPRISE PROMOTED BY CAPT. ALEXANDER McDOUGALL OF WHALEBACK FAME—NOTES FROM COAST SHIP YARDS.

At St. Louis on Saturday last Capt. Alexander McDougall of whaleback vessel fame presented to stockholders of the St. Louis Steel Barge Co. a steel steamer and two barges that have been specially designed for Mississippi river service, the barges to tow tandem, as is the custom on the great lakes. The steamer bears the name of its designer, McDougall, and is of 800 tons capacity. The barges are each of about 3,000 tons capacity and are equipped with steam steering gear and other modern appliances. It is expected that these three vessels will be the nucleus of a large fleet of similar design for river trade. A run was made up and down the river on Saturday with officers of the new barge company and a large number of invited guests aboard the vessels. The steamer was run into a sand bar so as to show how readily she might release herself by the operation of filling or emptying water compartments. Several vessel men from the lakes were in the St. Louis party, among them Capt. F. D. Herriman of the Great Lakes Register, Cleveland, and Geo. L. McCurdy of Chicago. James A. Dumont, supervising inspector-general of the United States steamboat inspection service, also witnessed the trials. Among stockholders in the St. Louis Steel Barge Co. are President Henry S. Potter, Gen. Mngr. Alex. McDougall, Secretary C. A. Cunningham, ex-Governor D. R. Francis, John Scullin, Howard Elliott, James Campbell, Festus J. Wade, Isaac H. Lionberger and John Fowler.

The Holmes Ship Building Co., West Mystic, Conn., has been awarded a contract to build a five-masted wooden schooner for the Sutton fleet of New Haven, Conn., of which ex-Lieut. Gov. James D. Dewell is the head. The dimensions of the schooner are: Length, 224 ft.; breadth, 45.9 ft.; depth, 22 ft. She will have three decks.

Arthur D. Story of Essex, Mass., has secured a contract to build another wooden steamer for a company soon to organize in Boston and to operate between Boston and Plymouth. The vessel will be 150 ft. long.

A new set of boilers is to be built for the Pacific Coast Co.'s steamship City of Puebla by Moran Bros. Co., Seattle, Wash. The work, including other repairs to the vessel, involves the expenditure of about $100,000.

Some time ago the Colombian government purchased the Gould yacht Atalanta and paid $60,000 upon the purchase price. The sale has now been cancelled; cause—change in the Colombian government. The yacht is at the Morse Iron Works, Brooklyn, undergoing extensive repairs.

Proposals will be received by the bureau of yards and docks, navy department, Washington, until Nov. 10, for the construction of a steel caisson for dry dock No. 1 at the navy yard, Boston.

E. C. Brewer, Elm park, Staten Island, is building a 240-foot floating dry dock for James Shewan & Sons. The new dock will be 80 ft. wide and capable of taking vessels of 2,000 tons.

Excellent progress is being made upon the new office buildings, machine shops and other extensions of the plant of the William R. Trigg Co., Richmond, Va.

Eight sectional barges and two deck lighters are to be constructed by Peter Hagan, East Camden, N. J., for work in the Delaware river.

Standard Oil Co.'s four-masted steel sailing ship building at the yards of Arthur Sewall & Co., Bath, Me., will be launched in December.

A five-masted wooden schooner, building at H. M. Bean's yard, Camden, Me., for J. G. Crowley, will be launched next month.

The Kingsford Foundry & Machine Works of Oswego, N. Y., is very busy in all departments. Centrifugal pumps made at these works are becoming very widely known, as several foreign shipments have recently been made and many unfilled orders still remain on the books. A new boiler plant, which will be one of the finest in the country, is fast nearing completion. The equipment will consist of three hydraulic riveters, and the necessary small tools for use in connection with same. The main building will be 315 ft. long and 120 ft. wide. A 30-ton electric crane with a span of 50 ft. will traverse the entire length of the building. All tools are to be driven with independent motors.

A FEW NOTES ABOUT YACHT DESIGNS.

BY THEODORE LUCAS

The increasing number and size of yachts—pleasure vessels of all kinds—has directed special attention of late to the question of efficient design for this class of vessel. A number of points have to be considered prominently. First of all is appearance. There ought to be that aristocratic simplicity and elegance that lifts a yacht out of the common crowd of ships as an artistic production. Second is the question of accommodations for the owner and guests. The arrangement should be such as to give the maximum of convenience and comfort. The decorations should be productions of beauty and in complete harmony to the purpose of the rooms. Charming effects can be realized by moulding the panels in the outlines of different styles of architecture, filling the panels in some cases with colored silks, canvas or similar warm and pleasing materials.

These first two points—appearance of the vessel and interior arrangements—are usually the main considerations with yacht owners, while the matter of the practical construction is quite often rather neglected, much to the detriment of the performance of the yacht. Owners could follow with advantage the example of the United States navy department in its procedure when contracting for warships. The navy decides upon what it needs and then makes a complete design first at its own expense, thus insuring right draught, right trim, right stability, right speed, and best of all, right cost. The experience of the navy is that such a complete design enables the ship builders to make a much closer estimate and a lower price than would be given on a less determined design. Such a complete design for a yacht should comprise:

I. Plans—1. Hull, showing profiles and deck plans, besides 'midship section, stem and stern post, outside plating, bulkheads, etc. 2. Machinery, showing engine, shafting, boiler, diagrams for valve gear, etc.

II. Specifications—A minute description of all details of hull and equipment, machinery, tests and trials.

III. Contract in the most approved legal form and containing provision for bonds as security, penalties for overtime, form of clear bill of sale, etc.

IV. Detail weight and cost account.

V. Lines of the yacht.

VI. Calculations—These are the most important investigations for the safety and comfort of the owner and the yacht. 1. Speed diagrams. 2. Strength calculations to prevent breaking in two. 3. Weight and center of gravity calculations for finding trim and stability. 4. Form calculations for displacements, centers, tons per inch, trim moments, etc. 5. Stability calculations, showing how far the yacht can be heeled safely. 6. Water-tight subdivision, showing position of bulkheads, to keep yacht afloat with two compartments flooded.

A design of this kind would enable a yacht owner or his representative to contract for a yacht with assurance that the vessel will be at the finish exactly as the owner desired her to be.

NEW YORK NAUTICAL COLLEGE.

As it is now certain that there will soon be quite a demand for ship masters who can handle vessels on salt water as well as on the great lakes, attention is directed to the nautical schools. They will find a wide field for their work on the lakes, especially among the young men. As announced in a display advertisement elsewhere in this issue, the New York Nautical College, Capt. Howard Patterson, principal, 130-132 Water street, New York, has been established eighteen years. Capt. Patterson was formerly of the United States navy, commander of the New York school-ship St. Mary's, and has written several well-known works of a navigation kind. The New York school has departments of navigation, seamanship and marine engineering, the latter in charge of Wm. A. Mintzer, formerly of the United States navy and instructor of steam engineering at the naval academy. The college now occupies nearly the entire building at 130-132 Water street, and numbers among its pupils several lake masters. Capt. Joseph W. Norcross, who was in the steamer Joseph L. Colby, and who is to take to the Atlantic coast one of the new Wolvin steamers now about completed at Cleveland, graduated from this college and obtained from the United States steamboat inspectors in New York the highest grade of ocean navigation license. Lake engineers are also schooled for salt-water licenses. Students may join at any time. An illustrated prospectus of the college will be sent to any address upon application.

LAUNCH OF TORPEDO BOAT DESTROYER LAWRENCE.

Nov. 7 has been fixed as the date for launching the torpedo boat destroyer Lawrence from the works of the Fore River Engine Co., Weymouth, Mass. The fact that the boat is to be launched with all her machinery on board has caused unusual preparations to be made for the occasion. Instead of allowing her to slide into the water she will be placed on a cradle which will be rolled into the stream and then lowered until the boat floats. This precaution is also deemed necessary because of the narrowness of the river and the thin hull of the destroyer. Miss Ruth Lawrence, a lineal descendant of Com. Lawrence, for whom the destroyer is named, will christen the boat. The McDonough, a twin ship, will be launched on Dec. 4.

The great success of the Deutschland and her superiority over her rival, Kaiser Wilhelm der Grosse, gives much pleasure to the advocates of forced draft, particularly of the Howden system. The officers of the Kaiser Wilhelm have repeatedly said that their ship would have done better in the recent race if there had been a head wind, for the weather being very calm and the air still, the furnaces lacked draft. It is well known that Howden's system gives a good, cool fire room, no heat being radiated from the ash pits, and a cool fire room counts for a great deal when firemen are working up to the limit of their physical powers. The mean speed of the Deutschland in the recent race was 23.36 knots an hour, that of the Kaiser Wilhelm being 22.40 knots, or 1 knot an hour less.

Italy has decided to abandon the 6-in. rapid-fire gun for battleship armament, and her four new ironclads will be fitted with two 12-in. and twelve 8-in. guns.

PHILADELPHIA'S GROWING COMMERCE.

Philadelphia is constantly sending out of late reports regarding new enterprises that will naturally enlarge the commerce of that port. A late addition is a fleet of new tank oil vessels, capable of carrying out of port 1,500,000 gallons of oil in bulk, and which are to have a terminus at Marcus Hook, the plant there being now in process of construction. The arrangements for the successful carrying out of this large enterprise have all been completed, and the steamships, which are now being built in the north of England, are about ready for service. David M. Ellis, representing, with his father, Joseph D. Ellis, the United States Pipe Line of Philadelphia, has just returned from Europe, where he successfully arranged matters, so far as the foreign terminus of the line is concerned. The United States Pipe Line Co. is capitalized at $10,000,000. Its western terminus is in Bradford, Pa., and the eastern terminus is at Marcus Hook. The pier or loading rack at Marcus Hook is now under construction and the work is being pushed with all possible vigor, so that the shipments will begin early this winter. There being no pier head line legally established by the state of Pennsylvania, the promoters of the syndicate were compelled to go to Washington and procure from the secretary of war permission to extend the pier to a point in the river that would not interfere with navigation. This permission was secured. The board of wardens about three weeks ago authorized the pier's construction. It is proposed by the new syndicate to load one steamer every five days at first, and this alone means that the shipments of oil from Philadelphia will be increased 100,500,000 gallons a year.

While independent of the Union Petroleum Co., which has also erected a plant at Marcus Hook within the past few months, the two concerns will, it is said, cooperate. The Union Petroleum Co. has already shipped nearly a million gallons of oil in barrels. The new plant of the United States Pipe Line Co., when completed, will be one of the largest in the country. Ten tanks, with a capacity of about 100,000 barrels, have already been erected. Both the Pennsylvania and Reading railroads approach the works.

There are persistent rumors that the Leyland line of steamships, which won trade between Boston and New York and Liverpool, will establish a branch of their service out of Philadelphia. This, coupled with the fact that the Baltimore and Ohio Railroad Co. recently completed two large piers for export purposes at Jackson street, Philadelphia, leads to the belief that there is more behind the rumors than has yet come to the surface.

INTERVIEW WITH ANDREW CARNEGIE.

Andrew Carnegie has just set sail from London for America on the Deutschland, and in a London interview he is made to say:

"We do not want to hurt 'little' Britain, but we intend to take her trade just the same. It does not surprise me to hear that the British manufacturers have found it necessary to abandon their fixed rate of £7 10 shillings ($36.49) for their product. American competition left no other course open to them. Notwithstanding this attempt to check the rising tide of Yankee commerce, we expect our success in foreign markets to continue without material interruption. Our weak spot lies in our transportation facilities, both by land and sea. The American manufacturers have unexcelled raw materials, abundant, cheap and close at hand. They have the most complete and perfect mechanical equipment in the world. What they now need is a reduction of the cost of transportation to the lowest possible level. Vast stretches of land and water separate the American manufacturers from their transatlantic customers. At present this distance acts as a welcome shield for British manufacturers. We Yankees wish to reduce its importance as near as possible to the vanishing point. So far as the Carnegie Co. is concerned, it intends to tackle the transportation problem in earnest. We will use every means in our power to put railroad and ocean freight rates on a bedrock basis. I think the prospects for a prosperous future in the United States were never so bright before. We need only unswerving persistence in sound fiscal and economical policies to outstrip our competitors in the forward march of nations."

A LARGE RIVET BUSINESS.

The Champion Rivet Co., Union street and Erie railway, Cleveland, has closed a contract for all of the boiler rivets intended for the boilers for some twenty-three new vessels now being built at different yards on the great lakes by the American Ship Building Co. These rivets are to be used in large Scotch marine boilers carrying from 200 to 250 pounds pressure. The largest diameter rivet is 1⅜ in. and the tonnage involved is 200 tons.

The Champion company has just completed shipment of an order for about 75 tons of Victor rivets intended for the cruiser Des Moines. These rivets were shipped to the Fore River Engine Co. at East Braintree, Mass. They were made strictly in accordance with the specifications for hull material for vessels of the United States navy, and inspected by the government inspector both at the steel works and at the factory in Cleveland. This is the first time in the history of the rivet business that an order of this kind came west of the Allegheny mountains. There is only one other concern in the country beside the Cleveland concern that is able to fill such an order, which must conform to and come up to the strict requirements of the inspectors for government work, both as to quality of material and perfection of workmanship.

The American Bridge Co. has secured a contract from the North German Lloyd Steamship Co. to erect a large foundry building and blacksmith shop in the company yards in Bremen. The contract calls for 800 tons of structural steel, all of which will be made in this country. The American Bridge Co. considers this one of the most important foreign orders it has taken for some time. The fact that the company competed successfully with German concerns right at home shows that our large industrial organizations are attaining one of the ends for which they were formed. The contracts for the North German Lloyd piers in Hoboken, it is also said, have been signed. The American Bridge Co. and the Pennsylvania Steel Co. were the lucky bidders, and it is understood that each company has half the entire contract.

REAR ADMIRAL O'NEIL'S ANNUAL REPORT.

With his annual report to the secretary of the navy Rear Admiral O'Neil, chief of the naval bureau of ordnance, submits estimates of appropriations required aggregating $7,457,855. The principal single item is $4,000,000 for armor and armament for new ships. Other items are: Reserve supply of ammunition, $500,000; purchase and manufacture of smokeless powder, $500,000; reserve guns for auxiliary cruisers, $250,000; additional naval magazine at Iona island, N. Y., $100,000; and new naval magazine near Boston, $500,000. Admiral O'Neil refers in complimentary terms to the superposed turrets of the battleships Kearsarge and Kentucky, and his comments are all the more interesting because of the understanding that he was at first not favorably impressed with the superposed turret. He says:

"The arguments for and against superposed turrets are well understood and need not be repeated, but it is a fact worthy of note that a considerable number of naval men who were opposed to the superposed turrets for various reasons have changed their views since they have seen them completed and in service. These turrets are a valuable addition to the naval service and reflect great credit on their designers and builders."

Concerning the tests of the turrets on the Kearsarge and Kentucky Admiral O'Neil says: "These vessels successfully stood their gun trials, and the double turret structures, which are trained by electric power, proved to be under perfect control and showed no signs of weakness, nor was any inconvenience experienced in the upper or lower turret due to the firing of the guns above or below. In fact, no unfavorable reports concerning the arrangement of the battery have been received. The vessels are without doubt an unqualified success, and while there is and probably always will be a decided difference of opinion among naval officers as to the merits, or, perhaps, more properly speaking, as to the advisability of the system, it must be admitted that it possesses certain very attractive features, among which are an absolute non-interference of guns, a heavy and unobstructed bow and stern fire, and the fact that the 8-in. guns—being mounted on the line of the keel—are available for service on either side, resulting in a very considerable saving of weight for equal efficacy."

Of the tests of the submarine boat Holland the admiral says that detailed information concerning the practice runs of the vessel have not been received, but it is probable that they were made under favorable conditions. He adds:

"It is believed that the boats now building of the Holland type will prove superior to the Holland in several important respects, but a more intimate and extended knowledge concerning them, their endurance, habitability, durability, reliability, etc., will be necessary before a correct estimate of their military value can be made. Well-trained and thoroughly-reliable crews are indispensable for submarine boats, and like all torpedo boats their efficiency will largely depend upon the nerve, dash and steadfastness of their personnel, and in view of the fact that several of such boats are now building, and must have officers and crews having some experience in their care and management, the bureau has recommended that the Holland be sent south for the winter months to serve as a school of instruction for officers and enlisted men, and the department having approved the same, she has been ordered placed in commission under the command of Lieut. H. H. Caldwell, U. S. N., and sent to Annapolis."

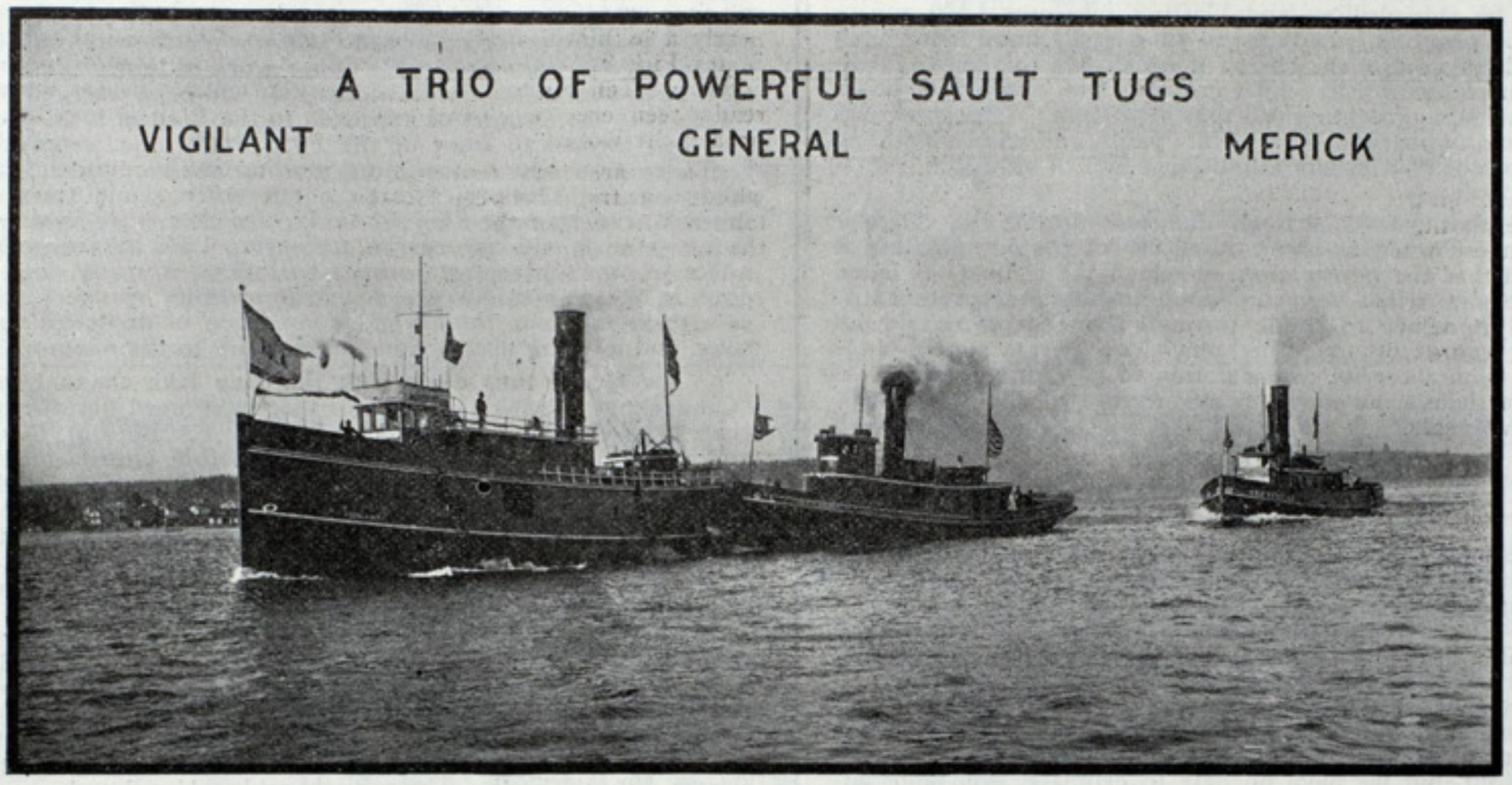
NEW TYPE OF TORPEDO BOAT.

A test was made in the model tank at the Washington navy yard last week of a model of a new type of torpedo boat. The vessel is a combination of some of the features of the submarine boats and ordinary torpedo craft. All the vitals are below the water line and the small surface of the vessel showing above the water is protected by cellulose, a material which expands on contact with liquids and stops leaks. The test was very favorable to the invention, the only objectionable features being the low speed developed, 14 knots, and a very perceptible wake. It is claimed that the vessel can be seen only at close quarters. There will probably be another test after an attempt has been made to so rearrange the boat to meet the objections made by the naval experts. The inventor is a New York man named Berger.

CHARLES H. CRAMP ON FORCED DRAFT.

The following letter, dated Philadelphia, Oct. 18, and published in the New York Herald, is self explanatory:

"I saw in the Herald of the 17th inst. an editorial entitled 'Why Should Forced Draft Be Used in Fast Steamers?' Taking the performance of the Russian cruiser Variag as a premise you say that 'it shows the necessity of reconsidering the engineering practices and precedents on which the employment of forced draft is based.' And you say further along that 'forced draft costs too much.' Permit me to suggest that while your conclusions are perfectly sound, so far as they go, you omitted to note one fact which lies at the bottom of the whole question, namely, that the revision of practices, etc., which you point out as necessary, involves, first of all, the use of the most approved type of water tube boilers in all cases where very high performance under natural draft is required within narrow limitation of weights. The performance of the Variag could not possibly have been approximated, much less equalled, by any weight of Scotch boilers she could have carried on her displacement, without forced draft of extreme power. Nor could it have been equalled under natural draft by any other type of water tube boiler than that with which she is provided. The maximum steam generating capacity of the Scotch boiler cannot be attained without forced draft equal to 2 in. of water in the tube with closed fire room or ashpit or induced draft equivalent to it. The difference between natural draft and forced draft in a Scotch boiler is usually equal to 25 or 30 per cent. of the normal. Therefore if it is contemplated to attain with natural draft a performance equal to that of forced draft with Scotch boilers, the weights must be increased in ratio of the difference. This would be out of the question in ships operating under the weight limitations of the Variag and I might add in any type of war ship now worth consideration. Indeed, the time is near at hand when the same rule will be recognized as applying with equal force to the higher classes of passenger vessels."



Vessels used by the Great Lakes Towing Co. for wrecking purposes.

OUR GROWTH AS A MANUFACTURING NATION.

The manufacturers of the United States are rapidly increasing their share in the foreign commerce of the country. Nearly one-half of the importations are now for their use and more than one-third of the exportations are their products. Their importations during the nine months ending with September, 1900, amounted to $281,000,000, a daily average of $1,000,000, while their exports of finished manufactures in the same time amounted to $338,000,000, a daily average of more than $1,250,000. Never before in the history of the country have the manufacturers imported so much material for use in manufacturing or exported so much of finished manufactures. In the corresponding nine months of last year the importations of manufacturers' materials amounted to $242,000,000, or $40,000,000 less than in the nine months just ended, and the exports of manufactures amounted to $277,000,000, or $60,000,000 less than in the corresponding months of this year. In the nine months of 1896 ending with September, the importations of manufacturers' materials amounted to $183,000,000, as against $281,000,000 in the corresponding months of 1900, and the exports of manufactures amounted to $184,000,000, as against $338,000,000 in the corresponding months of 1900. Thus the manufacturers during the four years have increased their importation of materials for use in manufacturing more than 50 per cent. and increased their exportation of finished manufactures more than 80 per cent. Manufacturers' materials a decade ago formed but 33 per cent. of the total importations; now they form over 45 per cent. of the total imports; while finished manufactures, which a decade ago formed but 18 per cent. of the exports, now form over 33 per cent. of the exports.

The first-class bell and third-class can buoy off Pointe Abbaye, Lake Superior, have been replaced by winter markers.

GEN. WILSON'S ANNUAL REPORT.

HE DEVOTES CONSIDERABLE SPACE IN IT TO THE WORK UPON THE GREAT LAKES—ESTIMATES FOR 1902.

The annual report of Gen. J. M. Wilson, chief of engineers, has just been filed with the secretary of war. His estimates for the fiscal year ending 1902 aggregate $20,000,000. The expenditures during 1900 were $18,485,298. The report is a complete review of all work done during the year. Of the Chicago drainage canal the report says that all interests affected cannot be satisfied and that the subject must be referred to congress for ultimate settlement. As to the lowering the level of the lakes Gen. Wilson says that investigations made under the direction of the deep waterways commission and by others may furnish data upon which further action upon the question may be based.

Gen. Wilson also says that a special report will be made to congress on the advisability of doubling the capacity of the St. Clair Flats canal and that it will indicate that prompt action is necessary and important to the safety and convenience of the vast commerce of the great lakes.

IMPROVEMENT OF THE DETROIT RIVER.

Referring to the improvements of the Detroit river, the report says: "Contract for the work on the Lime Kiln channel was entered into May 18, and work was commenced June 23, 1900, by drilling and blasting bed rock. Up to the end of the year (June 30) 413 blast holes, aggregating 2,197 ft. in depth, had been drilled and 2,087 lbs. of dynamite used in blasting, but none of the broken rock had been taken out up to date. The area covered by this drilling and blasting measures 1,500 square yards. Work was in progress from April to June 30, by hired labor, with derrick scow and diving outfit, the object of which was to remove bowlders from the channel below Lime-Kiln crossing; the number of bowlders taken out was 780, aggregating 543 tons in weight. This work was scattered over an area measuring 66,200 square yards, and its result was to provide a clear depth of 20 ft. where a limiting depth of only 18 ft. previously existed.

The commerce that passed through the river during the calendar year 1899 has been estimated as about 40,000,000 of freight tons, but it should be observed that the information on which the estimate is based is quite unsatisfactory, as it has been impossible to obtain accurate statistics having special reference to traffic through the Detroit river from the custom house records or any other official or private source. It is deduced, however, from a careful consideration of all custom records on the upper and lower lakes, and indicates an increase of about 10,000,000 tons in the past five years."

ST. CLAIR FLATS CANAL.

In connection with the doubling of the St. Clair Flats canal, the report says:

"No further estimate is submitted for work under the present approved project; but the emergency river and harbor act of June 6, 1900, called for survey and estimate, with a view to doubling the capacity of the canal, and full special report in the matter will be laid before congress at the beginning of its next session. It is therefore sufficient to state here that the report will indicate that prompt action is all important to the safety and convenience of the vast commerce of the great lakes. Traffic through the canal during the navigation period of the calendar year 1899—a period of nine months only—included the passage of about 40,000,000 tons of freight, but we have no data to estimate, even approximately, the extent of passenger traffic. The number of vessels that entered the harbor of refuge at Sand Beach, Lake Huron, during the year were 1,216, with a total tonnage of 687,029. The grand total of vessels that have found shelter there from 1877 to 1889, inclusive, is 27,465, the tonnage of which aggregated 9,664,107. During the present fiscal year it is proposed to rebuild the superstructure of the main breakway in concrete. The amount of money expended in improving the harbor up to the present time is $1,205,781. The estimated cost of rebuilding is $57,500."

The report says that the examination of the Muskegon river, the preliminary examination of channel from Lake Michigan to Stony Lake, Oceana county, and the preliminary examination at Arcadia, shows these projects to be unworthy of improvement. A report will be made to congress on the advisability of obtaining a channel at Muskegon harbor, the channel to have a depth of 20 ft. and uniform width of 300 ft. from the exterior to the interior lake.

CONNECTING WATERS OF THE GREAT LAKES.

The following report was made on the improvements of rivers and harbors on the eastern coast of Michigan and of waters connecting the great lakes:

Ship channel connecting waters of the great lakes between Chicago, Duluth and Buffalo.—This project was adopted by the river and harbor act of July 13, 1892, when the available depth for navigation through these waters was about 16 ft. Its object is to increase this depth to 20 ft. The estimated cost of the improvement was $3,340,000. Operations were commenced in the spring of 1893, and by June 30, 1898, channels of the prescribed depth had been completed, with widths varying from 300 to 2,400 ft. at all places specified in the original project, and through several other shoals where work was subsequently found to be necessary in order to accomplish the object in view. The total expenditure to June 30, 1899, was $2,751,554.86. Operations were in progress during the past fiscal year at Round island shoals, St. Mary's river, by which the dredged channels through these shoals were made wider and deeper. The work was commenced in September, 1897, and completed in November, 1899; the total amount of excavation was 448,313 cubic yards, bank measure. By this work the channels through these shoals were increased in width from 300 ft. to 800 ft., and in depth from 21 to 23 ft. Commerce is very much benefited by this improvement, the locality being open to high seas rolling in from Lake Superior and subject to dense fogs during the spring and fall months. In the lower Detroit river work was continued along the Grosse Ile lower range until Oct. 5, 1899. This work had been commenced in April, 1898. The total excavation was 84,045 cubic yards, and the improved channel thereby obtained now has a clear depth of 21 ft., with a uniform width of 300 ft. The depth before improvement was 15½ ft. Minor items of work were done at other places, such as removing small local shoals, or picking up scattering bowlders; many surveys and examinations by sweeping raft were made in connection with works of improvement in progress, or to obtain necessary data for future work. Congress has already appropriated the full amount of the estimate, and funds in hand will suffice for completing work contemplated by the original project. For this reason no additional estimate is now submitted.

ST. MARY'S RIVER IMPROVEMENTS.

"When the present project of improvement was adopted in 1886, the maximum draught which vessels could carry through the canal and locks at Sault Ste. Marie, Mich., was 16 ft., the old state lock of 1855 having 11½ ft. of water over miter sills, and the United States lock of 1881, now known as the Weitzel lock, 16 ft. Work under the new project was commenced in 1887, the essential purpose being to construct a new lock on the site of the old state locks, with a depth of 21 ft. over miter sills, and to enlarge and deepen the canal and its approaches correspondingly, the estimated cost of the proposed improvement being $4,738,865. The amount expended to June 30, 1899, was $3,802,986.17. The principal features of the projected improvement had been completed in 1896, the new lock, now known as the Poe lock, having been opened to navigation Aug. 3, of that year, and the canal deepened to a depth of 25 ft. Work since that time has been limited to further improvement relating to the canal approaches, including a partial reconstruction and extension of the canal piers. Operations during the past fiscal year included the construction of 416 linear feet of crib work for extending the northeast pier of approach to the Poe lock, and like work was still in progress at the close of the year with the purpose of carrying the extension 250 ft. farther. The object of this extension is to provide adequate and convenient berthing space for up-bound vessels while they are awaiting turn and opportunity to enter the lock. Other work of minor importance, included the removal of several bowlders that had been dragged by towlines of vessels into the channel of approach to the Weitzel lock, dredging shoals that had formed in front of the Fort Brady pier, removal of all spoil banks from the upper canal piers, grading and seeding the canal grounds, adjoining the south pier, setting out sixty shade trees in the canal grounds, constructing 2,600 linear ft. of picket fence in dividing line between grounds and city streets, and laying 1,334 square yards of concrete walks in approaches from streets to locks. A great deal of work was done in the way of surveys and examinations by sweeping raft, with a view to ascertaining the navigable condition of improved channels in the river, and locating obstructions preparatory to their removal."

"The report thus deals with the Hay lake channel improvements: "On account of rapids and shoals that intervened between the navigable channel of the river and the lake, at its head and foot, this channel was not navigable for commercial purposes before improvement. The original project of improvement of Oct. 27, 1882, contemplated the excavation of channels 17 ft. deep and 300 ft. wide through all obstructed portions of the Hay lake route, but this project was modified in 1886 to provide a depth of 20 ft., the total estimated cost being $2,659,115. The work of improvement was commenced in 1883, and the route opened to commerce June 7, 1894, though full width and depth of channel had not then been obtained at all points; but since then several shoals in the deep water section of the lake have been removed, and the dredged channels have been widened at angles and other critical points. The amount expended to June 30, 1899, was $2,112,333.49, and the improvement as it stood at that date comprised ten miles of channel dredged to a depth of 20 or 21 ft., in 6 miles of which the width was 300 ft., and in the remaining 4 from 450 to 1,100 ft. The new channel is 11 miles shorter than the old one via Lake George; it can be navigated with reasonable safety at night, which could not be done by the old route, and it is available for vessels drawing 5 ft. more water than could be safely carried through the latter. Operations during the past fiscal year were applied to completing the work of deepening the rock cut in a part of the middle Neebish section of the channel, and to rebuilding weak parts of the adjoining dike. The result of the work of deepening was to give an increased depth of 3 ft. through that part of the Neebish channel; the purpose of work done on the dike was to secure it against further wear, or possible destruction, and this was nearly accomplished at the close of the year. The whole commerce of the St. Mary's river passes through this channel, except small river steamers engaged in local traffic and rafts of logs which continue to be taken via the old channel as a measure of safety to general commerce. The surveys called for were duly made, and a report of this subject will be submitted to congress at its session in December next. In the meantime no action was taken respecting the continuing contracts authorized above, because the work should be made to conform with the more comprehensive scheme of improvement contemplated by the above-quoted provision of the last river and harbor act. It was therefore determined to defer action until the related surveys and estimates were completed, but this has now been accomplished and the contracts referred to will be made at an early date. It is believed that funds already appropriated will suffice for work that may be done under these contracts to June 30, 1902, and for this reason no additional appropriation is recommended at present."

Following is the estimate of appropriations for the great lake ports:

Harbor at Duluth, Minn., and Superior, Wis.	$ 320,000
Ashland harbor, Wis.	40,000
Waterway across Keweenaw point from Keweenaw bay to Lake Superior, Mich.	155,000
Marquette harbor, Mich.	54,500
Harbor of refuge, Grand Marais, Mich.	470,000
Sturgeon bay and Lake Michigan ship canal, Wis.	25,000
Sheboygan harbor, Wis.	48,000
Harbor of refuge, Milwaukee, Wis.	119,000
Milwaukee harbor, Wis.	51,000
Fox river, Wis.	50,000
Chicago harbor, Ill.	100,000
Chicago river, Ill.	75,000
Calumet harbor, Ill.	30,000
Calumet river, Ill. and Ind.	60,000
Illinois river, Ill.	60,000
Illinois and Mississippi canal, Ill.	1,000,000
Michigan City harbor, Ind.	48,000

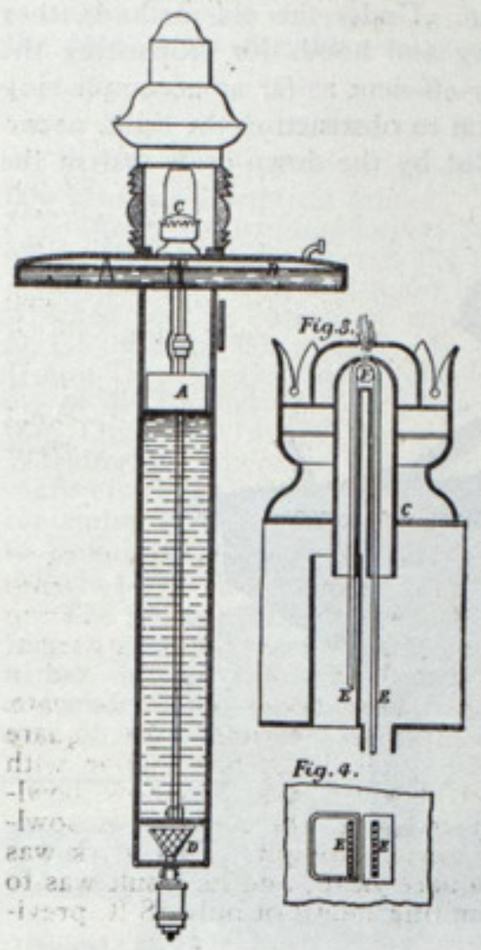
St. Joseph's harbor, Mich.	53,000
Kalamazoo river, Mich.	175,000
Holland harbor, Mich.	73,000
Grand river, Mich.	175,000
Muskegon harbor, Mich.	55,200
White Lake harbor, Mich.	27,500
Ludington harbor, Mich.	69,300
Manistee harbor, Mich.	42,000
Harbor of refuge at Portage Lake, Mich.	40,000
Frankfort harbor, Mich.	54,500
Petoskey harbor, Mich.	25,000
Saginaw river, Mich.	37,500
Detroit river, Mich.	200,000
Toledo harbor, O.	250,000
Sandusky harbor, O.	125,000
Huron harbor, O.	50,000
Black River harbor, O.	150,000
Cleveland harbor, O.	160,300
Fairport river, O.	210,000
Ashtabula harbor, O.	210,000
Erie harbor, Pa.	125,000
Conneaut harbor, O.	210,000
Buffalo harbor, N. Y.	250,000
Tonawanda harbor and Niagara river, N. Y.	164,000
Niagara river, Tonawanda to Port Day	26,000
Oswego harbor, N. Y.	160,000
Cape Vincent harbor, N. Y.	50,000

The report of Col. Jared A. Smith of the Cleveland district is incorporated in the report of Gen. Wilson. He estimates that it will require $353,000 to complete the present projected improvement and extension to the Cleveland breakwater. The estimate of $160,300 mentioned in Gen. Wilson's report is the amount needed to dredge the harbor of Cleveland to a depth of 21 ft.

The Nickel Plate road will sell tickets at one fare for the round trip, good going on Nov. 4, 5 or 6, for non-resident voters desiring to return home to vote, holding certificates signed by executive officer of state or county committees. Tickets good going on date of sale, good returning to and including Nov. 6. Write, wire, 'phone or call on nearest agent, C. A. Asterlin, T. P. A., Ft. Wayne, Ind., or E. A. Akers, C. P. & T. A., Cleveland, O. 243 Nov. 1.

AN OIL BUOY.

In view of interest attending the operation of gas buoys in this country, especially in connecting channels of the great lakes where probably seventy-five or more are maintained by the United States light-house board, we are reproducing from Engineering of London an illustration of one of the oil-lighted buoys introduced by Mr. J. Richardson Wigham, light-house engineer, of 33 Capel street, Dublin. The difficulty of using oil for such buoys lies in the necessity for trimming the wick as it chars, and consequently most illuminated buoys have hitherto burned compressed gas. In the buoy illustrated, Mr. Wigham has avoided the drawbacks named by causing the wick to move continuously over a roller at the burner, so that the flame continually springs from a fresh part of the wick. It is therefore possible for one of these buoys to burn without attention for a period of one to three months according to size.

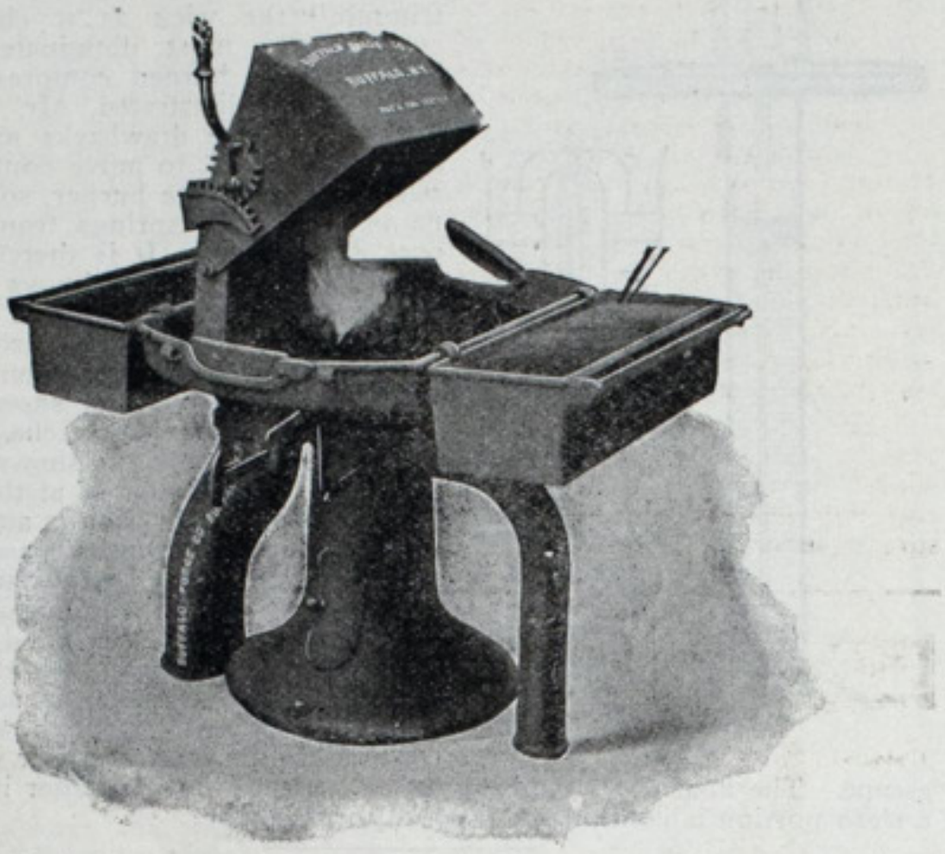


The construction of the burner and its accessories are clearly shown in the largest of the three sketches and in Fig. 4. The wire E, as shown in Fig. 3, passes over a roller F, at the burner C. One end of this wick is attached to a float A, whilst the other passes down a tube closed to the bottom and at the top opening onto the oil reservoir B. The float chamber A is filled with oil at starting to the level shown. At the bottom of this chamber is an adjustable drop valve D, through which the contents of the float chamber gradually escape. The float accordingly descends, pulling the wick after it, so that a fresh portion is continually exposed to the flame.

Townsend & Downey of New York have been awarded the contract for repairs to the coast geodetic survey steamer Bache.

DOWN-DRAFT SYSTEM OF FORGE CONSTRUCTION.

Officials of the Buffalo Forge Co., Buffalo, N. Y., are satisfied that the problem of smoke removal from forge fires is most satisfactorily solved by the Buffalo down-draft system. Under the old methods, they say, the arrangement of overhead piping and hoods for exhausting the smoke and gases was not extraordinarily efficient as far as accomplishing its purpose was concerned, and in addition to obstructing the light, necessitated frequent repairs and renewal. But by the down-draft system the



smoke and gases are completely removed (as soon as generated) by suction into the adjustable hood of cast iron at the side. Thence the exhaust current is conveyed away through tile piping, which is placed underground, as is also the blast or fresh air piping. By this arrangement there is no escape from the action of the suction hood in the largest and heaviest fires. The system is one of practical indestructibility, and interesting cases are on record where forges of this kind have been taken from plants destroyed by fire and reinstalled with perfect success. The atmosphere of the forge shop is rendered remarkably pure and free from smoke, and in summer is appreciably cooler, since there is no escape of hot gases into the room.

In the accompanying illustration is shown one type of Buffalo down-draft forge, which is adapted for moderate work, though the down-draft system is applied to forges of all sizes and requirements. As will be noted, the construction is heavy and substantial. Blast gates are attached to the forge, with levers for controlling the blast, and the Buffalo patent anti-clinker dumping tuyere permits the dropping out, at the bottom, of clinkers and ashes without disturbing the fire. For the purpose of supplying the blast and exhausting the gases, Buffalo blowers and exhausters are employed. Where the number of forges to be served is small, one machine, a combined blower and exhauster, may be used. Here the forge hoods are connected to the exhaust inlet of the fan, the discharge of which is into the blast pipe conveying air to the forges. Since, however, more air is drawn into the suction hoods than is delivered at the tuyeres, provision must be made at some point in the system for the escape of the surplus volume. This is effected by leading from the blast pipe to the outside atmosphere a by-pass connection, a self-acting damper which regulates the surplus escape, according to the blast required. That is, if all the blast gases are closed, the damper opens to allow all the air drawn in at the hoods to escape. The air which is drawn in with the gases at the hood insures that in the resulting mixture the oxygen will be abundantly sufficient for all combustion purposes. Where there is a large number of forges the system is installed with two independent fans, one for blowing and the other for exhausting, and for the latter purpose it is customary to employ steel plate exhaust fans in contradistinction to the cast iron shell blowers for blast service.

Eight years ago, Babcock & Wilcox boilers were put into the Wilson liner Nero. Up to the middle of this year this vessel had steamed 166,000 miles, the boilers giving excellent satisfaction. In 1895 the Hero, of the same line was fitted with similar boilers, and up to the same period she had steamed 131,000 knots. In 1896, the old cylindrical boilers were taken out of another steamer of this line and replaced by Babcock & Wilcox water tube boilers. She had made 104 voyages and run 106,300 knots up to July of the present year. In 1897 the same thing was done with the Orlando, which has made sixty-eight voyages and run 84,306 knots. In 1898 the Rollo was similarly overhauled and boiler changed and she has made forty-nine voyages and run 54,000 knots. In the same year the Otto was built, and up to date she has made ninety-nine voyages and steamed 52,000 knots. The Treno, built at the same time, was also equipped with water tube boilers, and she has made ninety-four voyages and run 52,000 knots. In 1899 Scotch boilers were removed from the Tasso, and since water tube boilers were installed she has made twenty-seven voyages and run 44,050 knots. Summing up the results we find that Wilson line ships fitted with Babcock & Wilcox boilers have made 800 voyages and steamed 700,000 knots and have given very little trouble. This is a record with which we think any maker of water tube boilers should be pleased.

TRADE NOTES.

Mr. M. De Puy of New York, inventor of the Paragon boiler, says he has recently made several improvements in the boiler that will greatly increase its efficiency.

Mr. Spencer Miller, chief engineer of the cableway department of the Lidgerwood Manufacturing Co., New York city, has returned from Europe after four months absence. It is understood that his latest invention, the marine cableway for coaling at sea, will be taken up by several of the navies of Europe.

Messrs. Hoopes & Townsend of Philadelphia, Pa., have contracted with the American Bridge Co. to build a bar mill building 70x500 ft. on the line of the Trenton cut-off of the Pennsylvania railroad. The American Bridge Co. is furnishing from its Minneapolis plant the structural steel for the roof of the state hospital at Glenwood, Iowa.

The organization of the Milwaukee Forge & Iron Co., Milwaukee, Wis., has been completed. This company will have a capital stock of $300,000. Fred C. Starke, formerly of the Sheriffs Manufacturing Co., will be president. The company intends to manufacture steamboat shafts and piston rods, dredging machinery and heavy forgings for machine shops. The plans for the company's buildings have been made and contractors are now figuring on the work of construction.

Cleveland is to have a new industry of some magnitude in the establishment of the Browning Engineering Co.'s plant at Collinwood. Work is to be pushed upon the plant and it is expected that it will be in operation during the coming winter. The company will manufacture principally hoisting machinery. B. F. Miller, formerly vice president of the National Carbon Co., is president; V. R. Browning, vice president; and E. H. Browning, secretary. Offices of the company are in the Western Reserve building. A dock capstan of new design is a specialty which they introduced recently.

Following is a note contained in a letter from the Reliance Gauge Column Co. of 70-80 East Prospect street, Cleveland: "Our columns have been indorsed both by the chief inspector of workshops and factories and the chief examiner of engineers for the state of Ohio. They are durable and entirely trustworthy and reliable. The internal mechanism, upon which successful operation depends, is a special feature of these columns. The floats do not slide up and down with the water and wear themselves out on the side of the column as is the case with any alarm where the float rests on the surface of the water. There is no movement, and therefore, no wear, unless the water gets high or low."

In a recent paper on "Mechanical Draft," read before the New England Cotton Manufacturers' Association, Walter B. Snow states that from a comparison of a considerable number of plants it appears that under ordinary conditions a single forced draft fan with direct connected engine and short stack can be installed for less than 20 per cent. of the cost of a brick chimney; a single induced draft fan with direct connected engine and short stack will cost less than 30 per cent. of a chimney; and a duplex induced draft apparatus, consisting of two fans with direct connected engines, inlet and outlet connections and short stack, will cost but little more than 40 per cent. of a chimney. This latter arrangement is only employed where, as in the case of an electric lighting plant, it is the practice to introduce relay units.

BUFFALO NAUTICAL SCHOOL.

It will be noted by an advertisement elsewhere in this issue that Buffalo also has a nautical school. The principal of the school, Mr. J. C. P. deKrafft, is the nautical expert at the United States branch hydrographic office, Buffalo. He entered the naval academy in 1881, being a member of the class of 1885, and upon leaving the naval academy in 1885 he was attached to the bureau of construction, navy department, Washington, D. C., until the fall of 1887. In October, 1887, he was transferred to the Union Iron Works, San Francisco, where he remained during the building of the Charleston, San Francisco, Monterey, Olympia and the battleship Oregon. In 1895 he was transferred to the hydrographic office, Washington, where he had charge of the publishing of the "Notices to Mariners for the Great Lakes," and other work connected with the lakes, remaining there until the fall of 1897. In November, 1897, he was ordered to Buffalo to establish the branch hydrographic office there, and has remained there since then.

The growing demand for increased skill in navigation has induced him to start the school to accommodate the large number of men who winter on the lower lakes, and as Mr. deKrafft is personally popular and undoubtedly competent, we venture to predict for him a large measure of success in his new venture.

AROUND THE GREAT LAKES.

In one day of this week, Wednesday, fourteen very large vessels left Chicago with grain, their cargoes aggregating 1,795,173 bushels.

The John J. Albright, one of the steamers building at the Cleveland works of the American Ship Building Co. for Capt. John Mitchell and others, will be launched Saturday at 10:30 a. m.

Subscribers to the Review who are having it forwarded to them through the marine postoffice at Detroit and the canal office at the Sault will confer a favor if they will arrange for change of address before the close of navigation.

Mr. F. W. Jackson of the marine department, Standard Oil Co., Cleveland, has given considerable study to the use of oil for quieting heavy seas and has done much towards putting into the hands of vessel men a great deal of valuable information regarding methods of using the oil. Of course there is no doubt of the value of oil when used by vessels against heavy seas. Alger, Smith & Co. of Detroit have repeatedly used it to advantage on their vessels when towing rafts of logs, and it is understood that Pickands, Mather & Co. of Cleveland, who control a very large fleet of vessels, have been arranging recently for the manufacture of 100 bags especially adapted to the distribution of oil, and which are to be supplied to their vessels. But Mr. Jackson proposes a wider scope for the oil. He has been studying reports of the recent Galveston disaster. The awful loss of life and destruction of property in the Texas city on the Gulf of Mexico was not due, he says, to a tidal wave, but to a great storm that caused high seas to wash over the island during an entire night. He is of the opinion that great tanks of oil, mounted on well constructed cribs, and provided with automatic valves that would become operative when the seas reached a certain height, would tend, in the event of another great storm on the gulf, to so calm the waves on the shores around Galveston as to render impossible another disaster of the kind that occurred a short time ago. The oil used aboard vessels, and which might be used in carrying out the Galveston suggestion, is, of course, of the very cheapest kind.

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DRY DOCKS.

American Ship Building Co.....Cleveland.
Bath Iron Works, Ltd.....Bath, Me.
Buffalo Dry Dock Co.....Buffalo.
Chicago Ship Building Co.....Chicago.
Craig Ship Building Co.....Toledo, O.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Shipbuilding Co.....Detroit.
Harlan & Hollingsworth Co.....Wilmington, Del.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Morse Iron Works & Dry Dock Co.....Brooklyn.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Pusey & Jones Co.....Wilmington, Del.
Townsend & Downey Ship Bldg. Co.....New York.
Union Dry Dock Co.....Buffalo.
Union Iron Works.....San Francisco.

ELEVATORS.

Morse, Williams & Co.....Philadelphia.

ELECTRIC AUTOMATIC WHISTLE OPERATORS.

Signal & Control Co.....New York.

ELECTRIC LIGHT AND POWER PLANTS.

Buffalo Forge Co.....Buffalo.
Electro-Dynamic Co.....Philadelphia.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Pelton Engineering Co.....Cleveland.
Sturtevant, B. F. Co.....Boston.
Westinghouse Electric & Mnfg. Co.....Pittsburg, Pa.

ELECTRIC HOISTS AND CRANES.

Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Lidgerwood Mnfg. Co.....New York.
Westinghouse Electric & Mnfg. Co.....Pittsburg, Pa.

ELECTRIC STEERING GEAR, SPEED AND RUDDER INDICATORS, ETC.

Electro-Dynamic Co.....Philadelphia.

ENGINE BUILDERS, MARINE.

American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works, Ltd.....Bath, Me.
Chicago Ship Building Co.....Chicago.
Chase Machine Co.....Cleveland.
Craig Ship Building Co.....Toledo, O.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Shipbuilding Co.....Detroit.
Farrar & Trefts.....Buffalo.
Fletcher, W. & A. Co.....Hoboken, N. J.
Fore River Engine Co.....Weymouth, Mass.
Gas Engine & Power Co. and Chas. L. Seabury & Co., Consolidated.....New York.
Hardy, John B.....Tacoma, Wash.
Harlan & Hollingsworth Co.....Wilmington, Del.
Hodge, S. F. & Co.....Detroit.
Jenks Ship Building Co.....Port Huron, Mich.
MacKinnon Mfg. Co.....Bay City, Mich.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Morse Iron Works & Dry Dock Co.....Brooklyn.
Neafie & Levy Ship & Engine Bldg. Co....Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Roach's Ship Yard.....Chester, Pa.
Sheriffs Mnfg. Co.....Milwaukee.
Trigg, Wm. R. Co.....Richmond, Va.
Trout, H. G.....Buffalo.
Union Iron Works.....San Francisco.
Willard, Chas. P. & Co.....Chicago.

ENGINE ROOM TELEGRAPH, CALL BELLS, ETC.

Cory, Chas. & Son.....New York.
Electro-Dynamic Co.....Philadelphia.

ENGINEERS, MARINE AND MECHANICAL.

Electro-Dynamic Co.....Philadelphia.
Hunt, Robt. W. & Co.....Chicago.
Miller, Walter.....Cleveland.
Pittsburgh Testing Laboratory, Ltd.....Pittsburg.
Powell, Ambrose V.....Chicago.
See, Horace.....New York.
Wood, W. J.....Chicago.

FANS FOR VENTILATION, EXHAUST, ETC.

Buffalo Forge Co.....Buffalo.
Sturtevant, B. F. Co.....Boston.

FEED WATER PURIFIERS AND HEATERS.

Learmonth, Robert.....Buffalo.
Warren Webster & Co.....Camden, N. J.

FIXTURES FOR LAMPS, OIL AND ELECTRIC.

Page Bros. & Co.....Boston.

FORGES.

Buffalo Forge Co.....Buffalo.
Sturtevant, B. F. Co.....Boston.

FORGINGS, IRON AND STEEL.

Bethlehem Steel Co.....South Bethlehem, Pa.
Bourne-Fuller Co.....Cleveland.
Cleveland City Forge & Iron Co.....Cleveland.

BUYERS' DIRECTORY OF THE MARINE TRADE.—Continued.

FLUSHOMETERS.
Kenney, The Co.....New York.

FURNACES FOR BOILERS.
Continental Iron Works.....New York.

FUELING COMPANIES AND COAL DEALERS.
Castner, Curran & Bullitt (Pocahontas)....Philadelphia.
Graham, James & Co.....Detroit.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.
Pittsburg Coal Co.....Cleveland.
Rochester & Pittsburgh Coal & Iron Co.....Buffalo.
Smith, Stanley B. & Co.....Detroit.
Youghiogheny & Lehigh Coal Co.....Chicago.

GAS BUOYS.
Safety Car Heating & Lighting Co.....New York.

GAS AND GASOLINE ENGINES.
McMyler Mnfg. Co.....Cleveland.
Olds Motor Works.....Detroit.

GAGES, STEAM AND VACUUM.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

GRAPHITE.
Dixon Crucible Co., Joseph.....Jersey City, N. J.

HAMMERS, PNEUMATIC.
Chicago Pneumatic Tool Co.....Chicago.
Philadelphia Pneumatic Tool Co.....Philadelphia.
Standard Pneumatic Tool Co.....Chicago.

HAMMERS, POWER DROP.
Chase Machine Co.....Cleveland.
Niles Tool Works Co.....Hamilton, O.

HAWSERS, WIRE.
American Steel & Wire Co.....Chicago.

HEATING APPARATUS.
Sturtevant, B. F. Co.....Boston.

HOISTS FOR CARGO, ETC.
American Ship Building Co.....Cleveland.
Brown Hoisting & Conveying Machine Co.....Cleveland.
Chase Machine Co.....Cleveland.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....New York.
Hodge, S. F. & Co.....Detroit.
Hyde Windlass Co.....Bath, Me.
Lidgerwood Mnfg. Co.....New York.
McMyler Mnfg. Co.....Cleveland.
Marine Iron Co.....Bay City.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

INDICATORS FOR STEAM ENGINES.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

INJECTORS.
Jenkins Bros.....New York.
Penberthy Injector Co.....Detroit.

INSURANCE, MARINE.
Brown & Co.....Buffalo.
Drake & Maytham.....Buffalo.
Elphicke, C. W. & Co.....Chicago.
Gibbs & Joys.....Milwaukee.
Hawgood & Moore.....Cleveland.
Helm, D. T. & Co.....Duluth, Minn.
Hutchinson & Co.....Cleveland.
Keith, J. G. & Co.....Chicago.
La Salle & Co.....Duluth.
Mitchell & Co.....Cleveland.
Osborn, F. H. & Co.....Chicago.
Pauly, H. J.....Milwaukee.
Parker, A. A. & W. B.....Detroit.
Peck, Chas. E. & W. F.....New York and Chicago.
Richardson, W. C.....Cleveland.

IRON ORE AND PIG IRON.
Bourne-Fuller Co.....Cleveland.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.

IRON OR STEEL STAYBOLTS, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

LATHES OF ALL KINDS.
Niles Tool Works Co.....Hamilton, O.

LAUNCHES—NAPHTHA, ELECTRIC.
Electric Boat Co.....New York.
Gas Engine & Power Co.....New York.

LIFE PRESERVERS, LIFE BOATS, BUOYS, RAFTS, ETC.
Armstrong Cork Co.....Pittsburg.
Drein, Thos. & Son.....Wilmington, Del.
Kahnweiler's Sons, D.....New York.
Lane & DeGroot.....Brooklyn.

LIGHTS, SIDE AND SIGNAL.
Page Bros. & Co.....Boston.

MACHINE TOOLS.
Niles Tool Works Co.....Hamilton, O.
Pelton Engineering Co.....Cleveland.

MACHINE TOOLS (WOOD WORKING).
Fay & Egan Co., J. A.....Cincinnati, O.

MARINE RAILWAYS, BUILDERS OF
Crandall & Son, H. I.....East Boston, Mass.

MATTRESSES, CUSHIONS, BEDDING.
Fogg, M. W.....New York.

METALLIC PACKING.
Katzenstein, L. & Co.....New York.
U. S. Metallic Packing Co.....Philadelphia.

METALS FOR BEARINGS.
Cramp, Wm. & Sons.....Philadelphia.
Magnolia Metal Co.....New York.
Phosphor Bronze Smelting Co., Ltd.....Philadelphia.

METAL POLISH.
Bertram's Oil Polish Co.....Boston, Mass.

MILLING MACHINES OF ALL KINDS.
Niles Tools Works Co.....Hamilton, O.

NAUTICAL INSTRUMENTS.
Bliss, John & Co.....New York.
Ritchie, E. S. & Sons.....Brookline, Mass.

NAVAL ARCHITECTS.
Curr, Robert.....Cleveland.
See, Horace.....New York.
Wood, W. J.....Chicago.

NICKEL STEEL FORGINGS.
Bethlehem Steel Co.....South Bethlehem, Pa.

OAKUM.
Stratford Oakum Co., Geo.....Jersey City, N. J.

OILS AND LUBRICANTS.
Dixon Crucible Co., Joseph.....Jersey City, N. J.
Standard Oil Co.....Cleveland.

PACKING.
Jenkins Bros.....New York.
Katzenstein, L. & Co.....New York.
U. S. Metallic Packing Co.....Philadelphia.

PAINTS.
Baker, Howard H. & Co.....Buffalo.
Smith, Edward & Co.....New York.
Upson-Walton Co.....Cleveland.

PAINTING MACHINES, PNEUMATIC.
Chicago Pneumatic Tool Co.....Chicago.

PATENT ATTORNEYS.
Thurston & Bates.....Cleveland.

PATTERN SHOP MACHINERY.
Fay & Egan Co., J. A.....Cincinnati, O.

PIPE, WROUGHT IRON.
Bourne-Fuller Co.....Cleveland.

PLANERS OF ALL KINDS.
Niles Tool Works Co.....Hamilton, O.

PLANING MILL MACHINERY.
Fay & Egan Co., J. A.....Cincinnati, O.

PLUMBING, MARINE.
Ellis Marine Plumbing Co.....New York.
Mott Iron Works, J. L.....New York.
Sands, Alfred B. & Son.....New York.
Kenney, The Co.....New York.

PNEUMATIC TOOLS.
Chicago Pneumatic Tool Co.....Chicago.
Philadelphia Pneumatic Tool Co.....Philadelphia.
Standard Pneumatic Tool Co.....Chicago.

POLISH FOR METALS.
Bertram's Oil Polish Co.....Boston.

PROPELLER WHEELS.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works, Ltd.....Bath, Me.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Shipbuilding Co.....Detroit.
Farrar & Trefts.....Buffalo.
Fore River Engine Co.....Weymouth, Mass.
Hardy, John B.....Tacoma, Wash.
Hyde Windlass Co.....Bath, Me.
Harlan & Hollingsworth Co.....Wilmington, Del.
Hodge, S. F. & Co.....Detroit.
Jenks Ship Building Co.....Port Huron, Mich.
MacKinnon Mfg. Co.....Bay City, Mich.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Morse Iron Works & Dry Dock Co.....Brooklyn.
Neafie & Levy Ship & Engine Bldg. Co.....Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Phosphor Bronze Smelting Co., Ltd.....Philadelphia.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Sheriffs Mnfg. Co.....Milwaukee.
Trigg, Wm. R. Co.....Richmond, Va.
Trout, H. G.....Buffalo.
Union Iron Works.....San Francisco.

PROJECTORS, ELECTRIC.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Rushmore Dynamo Works.....Jersey City, N. J.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

PUMPS FOR VARIOUS PURPOSES.
Blake, Geo. F. Mnfg. Co.....New York.
Davidson, M. T.....Brooklyn, N. Y.
Kingsford Foundry & Machine Works....Oswego, N. Y.
Wood, R. D. & Co.....Philadelphia.
Worthington, Henry R.....New York.

PUNCHES, RIVETERS, SHEARS.
Cleveland Punch & Shear Works Co.....Cleveland.
New Doty Mnfg. Co.....Janesville, Wis.
Niles Tool Works Co.....Hamilton, O.
Wood, R. D. & Co.....Philadelphia.

REGISTER FOR CLASSIFICATION OF VESSELS.
Great Lakes Register.....Cleveland.

RELEASING HOOKS FOR DETACHING BOATS.
Standard Automatic Releasing Hook Co.....New York.

RIVETS, STEEL, FOR SHIPS AND BOILERS.
Bourne-Fuller Co.....Cleveland.
Champion Rivet Co.....Cleveland.

RIGGING ROPE (WIRE).
American Steel & Wire Co.....Chicago.

RUBBER INSULATED WIRES.
Roebling's Sons, John A.....New York and Cleveland.
American Steel & Wire Co.....Chicago.

SAFETY VALVES.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

SAIL MAKERS.
Baker, Howard H. & Co.....Buffalo.
Upson-Walton Co.....Cleveland.
Wilson & Silsby.....Boston.

SALVAGE COMPANIES.
See wrecking companies.

SCHOOLS, CORRESPONDENCE—ENGINEERING AND NAVIGATION.
American School of Correspondence.....Boston.
Buffalo Nautical School.....Buffalo.
Chicago Nautical School.....Chicago.

SCREW MACHINES.
Niles Tool Works Co.....Hamilton, O.

SEARCH LIGHTS.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Rushmore Dynamo Works.....Jersey City, N. J.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

SHAPERS.
American Tool Works Co. (The).....Cincinnati.
Niles Tool Works Co.....Hamilton, O.

SHEARS.
See punches, riveters and shears.

SHIP AND BOILER PLATES AND SHAPES.
Bourne-Fuller Co.....Cleveland.

SHIP BUILDERS.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works, Ltd.....Bath, Me.
Buffalo Dry Dock Co.....Buffalo.
Cramp, Wm. & Sons.....Philadelphia.
Craig Ship Building Co.....Toledo, O.
Chicago Ship Building Co.....Chicago.
Detroit Shipbuilding Co.....Detroit.
Fore River Engine Co.....Weymouth, Mass.
Hardy, John B.....Tacoma, Wash.
Harlan & Hollingsworth Co.....Wilmington, Del.
Jenks Ship Building Co.....Port Huron, Mich.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Morse Iron Works & Dry Dock Co.....Brooklyn.
Neafie & Levy Ship & Engine Bldg. Co.....Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Roach's Ship Yard.....Chester, Pa.
Townsend & Downey Ship Bldg. Co.....New York.
Trigg, Wm. R. Co.....Richmond, Va.
Union Dry Dock Co.....Buffalo.
Union Iron Works.....San Francisco.
Willard, Chas. P. & Co.....Chicago.

SHIP CHANDLERS.
Baker, Howard H. & Co.....Buffalo.
Marine Supply Co.....Fairport Harbor, O.
Moran Bros. Co.....Seattle, Wash.
Upson-Walton Co.....Cleveland.

SPARS—LARGE SIZES.
Moran Bros. Co.....Seattle, Wash.

STAYBOLTS, IRON OR STEEL, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

STEAM VESSEL FOR SALE.
Holmes, Samuel.....New York.

STEEL OR IRON STAYBOLTS, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

BUYERS' DIRECTORY OF THE MARINE TRADE.—Continued.

STEAMSHIP LINES, PASS. AND FREIGHT.
American Line.....New York.
Erie & Western Trans. Co.....Buffalo.
International Nav. Co.....Philadelphia.
Red Star Line.....New York.

STEEL SHAFTS, SOLID OR HOLLOW.
Bethlehem Steel Co.....South Bethlehem, Pa.

STEERING APPARATUS.
American Ship Building Co.....Cleveland.
Chase Machine Co.....Cleveland.
Detroit Shipbuilding Co.....Detroit.
Electro-Dynamic Co.....Philadelphia.
Hyde Windlass Co.....Bath, Me.
Jenks Ship Building Co.....Port Huron, Mich.
Queen City Engineering Co.....Buffalo.
Sheriffs Mnfg. Co.....Milwaukee.

STOCKS, BONDS, SECURITIES.
Wright, Herbert & Co.....Cleveland.

STOCKLESS ANCHORS.
Baldt Anchor Co.....Chester, Pa.
International Anchor Co.....Cleveland.

STRUCTURES OF STEEL, BUILDERS OF.
American Bridge Co.....New York.

SURVEYORS, MARINE.
Curr, Robert.....Cleveland.
Gibbs & Joys.....Milwaukee.

TELEGRAPH—DECK AND ENGINE ROOM.
Cory, Chas. & Son.....New York.

TESTS OF MATERIAL.
Hunt, Robert W. & Co.....Chicago.
Pittsburgh Testing Laboratory, Ltd.....Pittsburg.

THERMOMETERS FOR MECHANICAL PURPOSES.
Helios-Upton Co.....Peabody, Mass.

TIMBER—LARGE PIECES.
Moran Bros. Co.....Seattle, Wash.

TOOLS, METAL WORKING, FOR SHIP AND ENGINE WORKS.
Chicago Pneumatic Tool Co.....Chicago.
Cleveland Punch & Shear Works Co.....Cleveland.
New Doty Mnfg. Co.....Janesville, Wis.
Niles Tool Works Co.....Hamilton, O.
Pelton Engineering Co.....Cleveland.
Philadelphia Pneumatic Tool Co.....Philadelphia.
Standard Pneumatic Tool Co.....Chicago.
Wood, R. D. & Co.....Philadelphia.

TOOLS, WOOD WORKING.
Fay & Egan Co., J. A.....Cincinnati, O.

TRUCKS.
Boston & Lockport Block Co.....Boston.

TOWING MACHINES.
American Ship Windlass Co.....Providence, R. I.
Chase Machine Co.....Cleveland.
Playfair's Barge & Tug Line.....Midland, Ont.

TOWING COMPANIES.
Donnelly Salvage & Wrecking Co.....Kingston, Ont.
Swain Wrecking Co.....Detroit.

TUBING FOR BOILERS.
Shelby Steel Tube Co.....Cleveland.

VALVES, STEAM SPECIALTIES, ETC.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.
Jenkins Bros.....New York.

VARNISH MAKERS, COLOR GRINDERS, ETC.
Smith, Edward & Co.....New York.

VARNISH PAINT.
Mair, John & Son.....Philadelphia.

VESSEL AND FREIGHT AGENTS.
Boland, John J.....Buffalo.
Brown & Co.....Buffalo.
Drake & Maytham.....Buffalo.
Elphicke, C. W. & Co.....Chicago.
Gibbs & Joys.....Milwaukee.
Hall & Root.....Buffalo.
Hawgood & Moore.....Cleveland.
Helm, D. T. & Co.....Duluth, Minn.
Holmes, Samuel.....New York.
Hutchinson & Co.....Cleveland.
Keith, J. G. & Co.....Chicago.
Mitchell & Co.....Cleveland.
Moffat & O'Brien.....San Francisco.
Pauly, H. J.....Milwaukee.
Richardson, W. C.....Cleveland.

VENTILATING APPARATUS FOR SHIPS.
Buffalo Forge Co.....Buffalo.
Sturtevant, B. F. Co.....Boston.

WIRE ROPE AND WIRE ROPE FITTINGS.
American Steel & Wire Co.....Chicago.
Baker, H. H. & Co.....Buffalo.
Roebling's Sons, John A.....New York and Cleveland.
Upson-Walton Co.....Cleveland.

WHISTLES, STEAM.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.
Signal & Control Co.....New York.

WINDLASSES.
American Ship Windlass Co.....Providence, R. I.
American Ship Building Co.....Cleveland.
Hyde Windlass Co.....Bath, Me.
Jenks Ship Building Co.....Port Huron, Mich.

WINCHES.
American Ship Windlass Co.....Providence, R. I.
Hyde Windlass Co.....Bath, Me.

WOOD WORKING MACHINERY.
Fay & Egan Co., J. A.....Cincinnati, O.

WORM GEARING.
Morse, Williams & Co.....Philadelphia.

WRECKING AND SALVAGE COMPANIES.
Donnelly Salvage & Wrecking Co.....Kingston, Ont.
Playfair's Barge & Tug Line.....Midland, Ont.
Swain Wrecking Co.....Detroit.

YACHT SAILS, FITTINGS, HARDWARE, ETC.
Wilson & Silsby.....Boston.

YACHT AND BOAT BUILDERS.
Drein, Thos. & Son.....Wilmington, Del.
Electric Boat Co.....New York.
Gas Engine & Power Co.....New York.
Lane & DeGroot.....Brooklyn.
Willard, Chas. P. & Co.....Chicago.

YAWLS.
Drein, Thos. & Son.....Wilmington, Del.
Lane & DeGroot.....Brooklyn.

ALPHABETICAL INDEX OF ADVERTISERS IN THE MARINE REVIEW.

The star (*) indicates that the advertisement appears alternate weeks. For addresses see advertisements on pages noted.

LAKE SHORE & MICHIGAN SOUTHERN RAILWAY.

CLEVELAND CITY TICKET OFFICE,
237 SUPERIOR STREET.

Eastward:—	Ar. fr. West.	Dep. East.
No. 18, Southwestern Limited	.....	*1 55 am
No. 22, Lake Shore Limited	*2 15 am	*2 20 am
No. 28, New York & Boston Express	*7 40 am	*8 00 am
No. 32, Fast Mail	*11 25 am	*11 30 am
No. 44, Accommodation, via Sandusky	†1 25 pm	.....
No. 46, Southwestern Express	.....	*3 00 pm
No. 6, Limited Fast Mail	*5 40 pm	*5 45 pm
No. 10, Chicago, New York & Boston Special	*7 35 pm	*7 40 pm
No. 16, New England Express	*10 30 pm	*10 35 pm
No. 2, Day Express	†9 05 pm	†9 20 pm
No. 126, Norwalk Accommodation	†7 55 am	.....
No. 40, Toledo & Buffalo Accom., via Norwalk.	†10 00 am	†10 30 am
No. 126, Norwalk Accommodation	†7 55 am	.....
No. 116, Conneaut Accommodation	.....	†4 30 pm

Westward:—	Ar. fr. East.	Dep. West.
No. 11, Southwestern Limited	*3 25 am	.....
No. 15, New York, Boston & Chicago Special	*3 05 am	*3 10 am
No. 21, New York & Chicago Express	*5 10 am	*5 20 am
No. 7, Day Express	.....	†6 30 am
No. 19, The Lake Shore Limited	*7 35 am	*7 40 am
No. 23, Western Express	*11 10 am	*11 15 am
No. 33, Southwestern Express	*12 25 pm	.....
No. 133, Cleveland & Detroit Express	.....	*12 30 pm
No. 47, Accommodation	.....	†3 00 pm
No. 141, Sandusky Accommodation	.....	†3 10 pm
No. 127, Norwalk Accommodation	.....	†5 10 pm
No. 37, Pacific Express	*6 35 pm	*7 00 pm
No. 3, Fast Mail Limited	*10 50 pm	*10 55 pm

*Daily. †Daily except Sunday.
Trains Nos. 28 and 37 run via Erie station.

WANTED FOR SALE, FOR CHARTER Etc.

Space under this heading 25 cents a line, each insertion, for three insertions or less. Special rates for periods of more than three insertions.

—FOR SALE—A new $1,200 gasoline launch for $700; guaranteed at every point. Address C. N. Tallman, care Post Standard, Syracuse, N. Y. Nov. 8

—DREDGE FOR SALE—A small Bucyrus dredge, one-third yard dipper. Machinery in first-class order. Will build new hull to suit purchaser. Sandusky Portland Cement Co., Sandusky, O. Nov. 1

—WANTED—Loan of $1,000 on steamboat property. Will give good security. Address box 10 the Marine Review Pub. Co., Cleveland, O. Nov. 8

—WANTED to purchase, rent or charter tug and scows, capacity of the latter to be 1,000 to 1,500 tons. Steambarge owners correspond. Stone to the transported from our pier at Stone Haven, 7 miles north of Port Washington, to Lake Michigan ports. Lake Shore Stone Co., Belgium, Ozankee Co., Wis. Nov. 8

—FOR SALE—Passenger steamer 177 ft. over all. In good condition. Carries 500 tons freight. Allowed 500 passengers; will sleep 120 and can be made to sleep 200. Steeple compound engines, double fire-box boiler. Speed, 11½ miles. Reason for selling is that vessel is not speedy enough for present service. Address Passenger steamer, The Marine Review Pub. Co., Cleveland. tf

—FOR SALE AT CLOSE OF LAKE NAVIGATION—Machinery and boiler of steamer Forest City. Engine steeple compound, 22 and 40x36 in. stroke. In good order. Address E. T. Peck, 691 Cass ave., Detroit, Mich. Oct. 25

—FOR SALE—Two tugs, one of 65 ft. keel with engines 20x22 and the other of 61 ft. keel with engines 20x20. Ranney Bros., 34 River st., Cleveland. Nov. 15

—FOR SALE—Good tug, six years old. Engines 18x20. Boiler allowed 130 pounds steam pressure. Address Box 284, Ashland, Wis. tf

MARINE REVIEW

VOL. XXII. CLEVELAND, O., NOVEMBER 1, 1900. No. 18.

"BETHLEHEM" FORGINGS

have scored another triumph in the remarkable results attained during the recent speed tests of U. S. Battleship "Wisconsin" and Russian Cruiser "Variag."

The shafts and engine-forgings of both ships are representative products of our Works, and demonstrate anew the possibilities of Fluid-Compressed Nickel and Carbon Steels, when thoroughly forged under hydraulic pressure and carefully annealed.

SEND TO OUR NEAREST OFFICE FOR PAMPHLET.

BETHLEHEM STEEL COMPANY,

SOUTH BETHLEHEM, PA.

BRANCH OFFICES:

100 Broadway, New York.
421 Chestnut Street, Philadelphia.
1433 Marquette Building, Chicago.
312 Perry-Payne Bldg., Cleveland.
340-342 Main Street, Cincinnati.
430 Endicott Building, St. Paul.
726 Gravier Street, New Orleans.
4 Bank Block, Denver.

WILSON & SILSBY, Rowe's Wharf, BOSTON, MASS.

We furnished the Sails for
DEFENDER,
COLONIA,
IUBILEE,
NAVAHOE.

PARTICULAR ATTENTION GIVEN TO
SAILS FOR RACING YACHTS.
ALSO THE
OUTFITS OF LARGE STEAM YACHTS.

THE CHASE MACHINE COMPANY,

Engineers and Machinists,

MANUFACTURERS, UNDER THE CHASE PATENTS OF

FOG WHISTLE MACHINES, HOISTING ENGINES,
STEERING ENGINES, AUTOMATIC TOWING ENGINES.
POWER AND DROP HAMMERS, AND OTHER MACHINERY
ENGINEERS' SUPPLIES, AND GENERAL JOB WORK.

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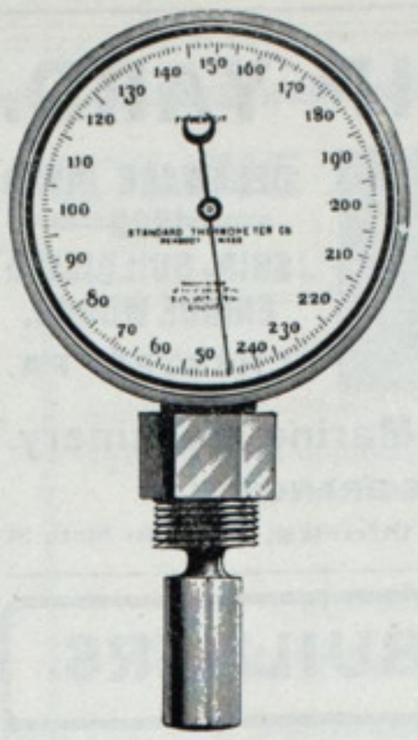

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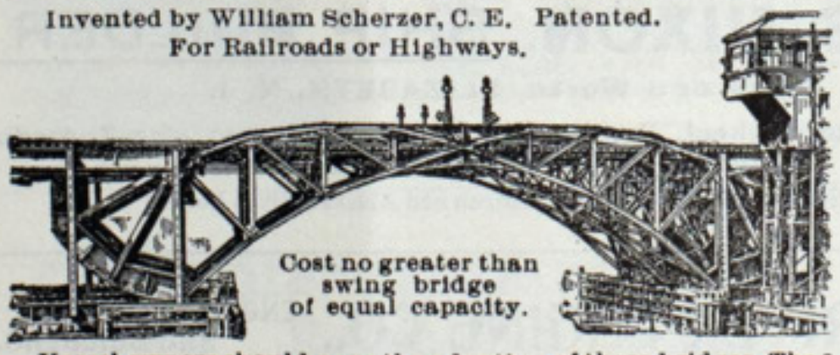

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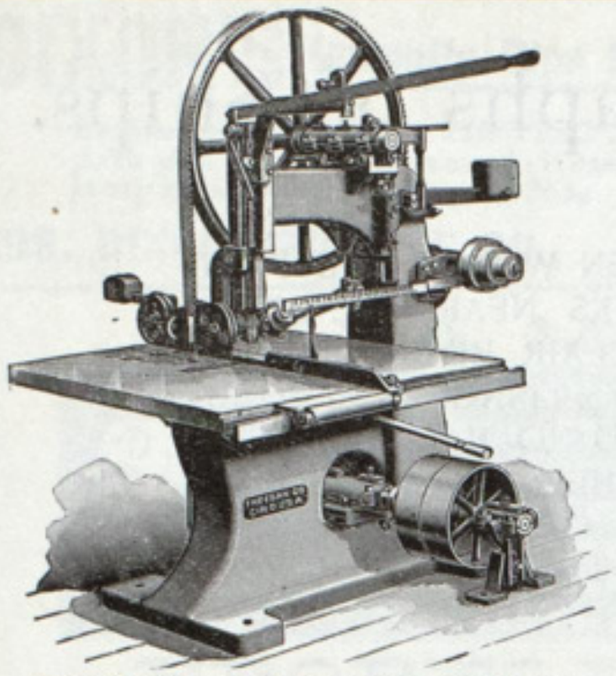

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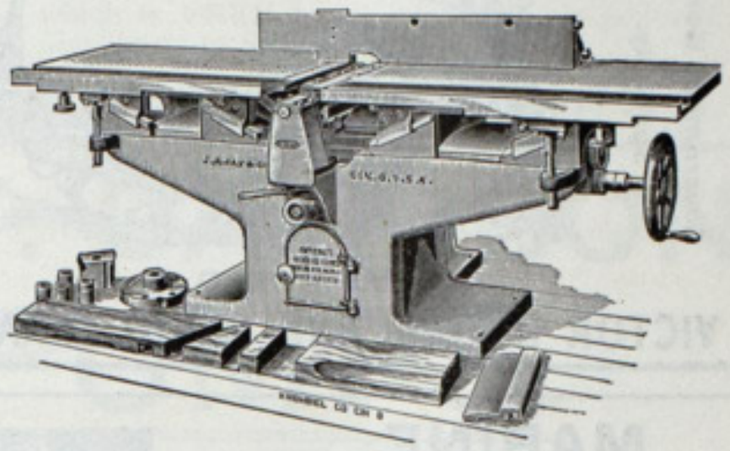

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